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Europe/Latin America Report

SCIENCE AND TECHNOLOGY

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EUROPE/LATIN AMERICA REPORT

SCIENCE AND TECHNOLOGY

CONTENTS

WEST EUROPE

EAST EUROPE

BIOTECHNOLOGY

SCIENTIFIC AND INDUSTRIAL POLICY

LATIN AMERICA

SCIENTIFIC AND INDUSTRIAL POLICY

TECHNOLOGY TRANSFER

/7310

FRG CERAMICS CONFERENCE EXAMINES NEW TESTING, MANUFACTURING

Duesseldorf VDI NACHRICHTEN in German No 44, 31 Oct 86 p 17

[Article by Manfred Wegner: "With Ceramic Materials, the Surface Is Being Discovered": first paragraph is VDI NACHRICHTEN introduction]

[Excerpts] Wunsiedel, 31 Oct (VDI)--The future of industrial ceramics will depend mainly on new methods in physical surface analysis and on surface processing methods. This is the gist of the conclusions of the German Ceramic Association's (DKG] annual conference which took place in mid-October in the pine mountain resort of Wunsiedel, in the heart of the Bavarian-Oberfranken porcelain industry.

Although it is clear, extensive ceramics euphoria norwithstanding, that the technology is still emerging, Helmut Lehmann, president of the DKG, can nonetheless already point to some successes in the application of industrial ceramics, mainly in automobile manufacturing: the 300 Audi 80 GTE models which, for test purposes, were manufactured with ceramic exhaust manifolds, and the Daimler-Benz tests with ceramic-coated swirl chambers, ceramic turbochargers, and piston heads. However, he stressed at the annual DKG conference that the future of ceramics research must be characterized primarily by interdisciplinary approaches. Limited activity has little hope of success, especially if one hopes to qualify for the R&D subsidy plan of the minister for research and technology.

A decisive contribution to the optimization of ceramic surfaces is expected in the future from improved physical analysis methods--from methods already established in the analysis of classical materials but which have been or still need to be adapted to the special requirements of ceramic materials. Among others, secondary ion mass spectrometry [SIMS] with neutral primary particles for the analysis of surfaces and thin layers of ceramic materials was introduced, as developed by Professor Frischat et al. at Clausthal-Zellerfeld Technical University. This SIMS system with charged primary particles did not cause problems in the analysis of electrically conductive materials, but results in the examination of poor conductor materials such as ceramics would not be reliable because of static loading and electrolysis of the surface material. The application of electronic analysis systems such as the Auger

Electron Spectroscopy (AES) will also be of great importance in the field of composites. Analyses of the mechanisms at the boundary surfaces of reinforcing fibers and matrix, that is, those complex relations which make both of them dependent on material and sintering curves, are of great importance to the quality of the material.

Special procedures in ceramics technology are also approaching the field of surface processing, or more precisely, surface coating. According to Prof G.K. Wolf of the Physico-Chemical Institute of Heidelberg University, ion implantation, which has been part of the technology in semiconductor applications for some time, can also be applied to the coating of ceramic surfaces. This procedure permits, through a structural change, a modification of such mechanical surface characteristics as hardness, brittleness, and wear.

The fact that technical applications of ceramic materials are still at an early stage with respect to their potential is due, among other things, to the widespread lack of knowledge on ceramic materials on the part of manufacturers, as Dr Markus Blumenberg, secretary of the DKG, stated in passing at the conference. The application of ceramic materials in technical equipment and processes would require "design adaptation suited to the materials", i.e., ceramic specific, based on the special characteristics of ceramics.

In this context, Blumenberg also mentioned the situation in technical universities.

Until now, ceramics research was almost exclusively aimed at the development of new materials. What was missing was ceramics engineering. Consequently, the DKG has great hopes for the new professorships in Karlsruhe and Aachen. In particular, stimulus for the constructive application of ceramics is expected from the RWTH [Technical University of Rhine-Westfalia] in Aachen.

Caption:

At present, an all ceramic engine is not conceivable in the German automobile industry; however, individual ceramic components such as exhaust manifolds and piston heads are already being mass-produced and installed; this was reported at the DKG conference in October in Wunsiedel. In contrast, artificial ceramic hip joints have been standard for years. There are new breakthroughs in the field of dental implants, where ceramic is particularly suitable thanks to its chemical stability and electroneutrality (no formation of tartar). Ceramics also increasingly replace metals when these reach the limit of efficiency. The spherical stopcock made of pure aluminum oxide-ceramic (pictured), silicon nitride, and silicon carbide has proved successful in the control and regulation in the chemically aggressive environment of flue gas desulphurization systems.

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FRG INDUSTRIALISTS PLAN COMMERCIAL USES OF SPACE TECHNOLOGY

Munich INDUSTRIEMAGAZIN in German Feb 87 pp 86-94

[Article: "Celestial Business"; first paragraph is introduction]

[Excerpts] Space travel. Spurred on by the economic success of the Ariane carrier rockets, European business is all set to go into space travel. The Germans are best equipped for the next step, the industrial use of space laboratories.

In what used to be the exclusive domain of government authorities, with space technology suppliers earning their daily bread primarily from subsidized government contracts, there is an increasing number of private-sector initiatives, while users outside the space industry are also clearly going after the opening up of new space markets. One sign: Although BMFT [FRG Ministry for Research and Technology] invested one and a half times the amount of money in space research in 1986 that it did in 1982, total West German space expenditures doubled in the same period, meaning that the share of financing from users, including the Bundespost, rose.

Commercialization worldwide has made the greatest strides in satellite communications, and thus in the carrier rocket business linked to it. In contrast, the private-sector marketing of photographs and data from earth observation and remote sensing satellites has only just begun.

Oberpfaffenhofen GmbH, the remote sensing company that intends to follow the American and French example and take over the marketing of satellite photos and observation data from the governmental German Aerospace Research and Testing Institute (DFVLR), is still in a formative stage. The DFVLR is still negotiating with firms involved in aerial plotting and photography that, with MBB and Dornier as partners, wish to boost the demand of the highly diverse clientele--mineral prospecting companies and surveying agencies, environmental authorities and cartography and construction firms.

The promoters of the new billion-mark programs--the free-floating, retrievable "Eureca" space platform, the "Columbus" project, with its space station elements, the significantly stronger "Ariane 5" carrier rocket and the "Hermes" mini-space shuttle--are secretly hoping to be able to repeat the amazing success of the first generations of Ariane: European rockets have

emerged as a leading force on the market, having long since made up for government aid, while the European "Airbus" is sinking deeper and deeper into the red.

For this to happen, the French at one point had to push through the development of Ariane against the wishes of the Germans, who--frustrated by the failures of the forerunner to the program and bearing in mind the supposedly superior Shuttle transports by the Americans--were doubtful about its economic feasibility.

Today, Friedrich Laussermair, head of MAN Technologie GmbH, praises the "great French feat"--and not just because his company has a profitable sales figure of around DM 100 million from the production of Ariane components (quota of orders: nearly 10 percent) and has been able, as a partner of the private-sector space transportation firm Arianespace in Paris, to enjoy profits that, while still modest, are nonetheless on the rise.

Laussermair can also draw up a positive macroeconomic balance sheet:

--The Ariane program currently employs some 8,000 Europeans in highly-skilled positions, 1,100 of whom are in the FRG. By 1990, the corresponding figures should be 10,000 and 2,000.

--It is true that Ariane is not encumbered by developmental costs; they are borne by the participating national governments. However, while the 18 missions already launched and the 23 firmly booked missions according to Laussermair "repay the developmental costs twice over in the form of taxes and surcharges," U.S. General Accounting Office figures indicate that the NASA Shuttle does not come close to even covering operating costs.

Without Arianespace, things would have looked gloomy for satellite operators eager to launch after the failure of the Shuttle; consequently, the company is booked through 1990. The reason for Ariane's own failed launch last year has presumably been discovered, so that the program can continue this summer.

Although NASA wishes to limit itself to military and scientific missions in the future, this quasi-monopoly will not last. U.S. suppliers, Japan and China are already moving into the void. Arianespace general manager Charles Bigot is pursuing a long-term goal of 50 percent of the market for telecommunication satellite launches--approximately 10 a year.

He feels that larger capacities are too risky, although he anticipates that the frenzied growth of the last few years will calm down. Horst Froehlich, head of the electronics division at Dornier System GmbH in Friedrichshafen, provides a reason for this: On the big inter- and transcontinental directional radio links, glass fiber cable will "in the long run take part of the market away" from telecommunications satellites. The best chances that transmission stations in space will have in the future is as junction points for mobile communication with ships, airplanes and trucks--in part for navigational purposes--and for the direct, cable-free distribution of television programs to homes.

From all this, the German suppliers of satellite systems--ANT Nachrichtentechnik GmbH, Siemens, MBB-Erno and Dornier--are also hoping for a better position. This is because "the relatively well-developed terrestrial communication network has up to now had an inhibitive effect on satellite use in Europe and, compared to the United States, fewer innovative technologies have emerged," industry expert Froehlich says

BMFT is helping the new technological push--embodied in the German-French TV-Sat project and the "DFS Kopernikus" national telecommunications satellite--through massive injections of funding.

Impulses for Innovations on Earth

The big business in the future will admittedly be on earth, with small satellite dishes for personal TV reception and mobile compact terminals for the transmission of speech and data via satellite. The ESA estimates the European market volume in these areas from 1985 to 1995 at DM 20 billion and DM 6 billion, respectively. Manufacturers of antennas alone--not least of all from Japan--will get a large chunk of this.

Nevertheless, the innovation spinoffs radiating from the German and European space programs into other branches of industry should not be scoffed at, even if one should not get one's hopes up too high.

Methods of project management and systems engineering, standards for quality control and safety analyses, which were drawn up or further developed for the most part in the U.S. space program, are widely used in technically-oriented branches of industry in this country as well. "Modern work methods, the standardization and improvement of European standards and the training of German industry for international cooperation," are the blessings of the Ariane program mentioned by MAN executive Laussermair.

However, Laussermair, who holds two doctorate degrees (engineering and physics), also knows of more tangible spinoffs--from improved computer-assisted calculation and design processes to new materials and construction methods.

As an example, MAN worked together with mechanical engineers to develop a milling machine controlled simultaneously in five axes so that the geometrically complicated turbine and pump wheels for Ariane thrusters could be produced economically. The entire unit, together with its ingenious control software, which helped save 60 to 70 percent of costs compared to conventional CNC machines, has in the meantime become available on the market.

MAN introduced the same five-axis technology to automatic coordinate measurement. The unit currently being manufactured under license takes the measurements of all the components during the unmanned night shift, so that they can be manufactured to form the next morning--an important step in the direction of fully automated production.

MAN space project head Klaus Kaiba hopes for a new thrust of innovation from the "Ariane 5" program. MAN will be producing the three-meter-long booster

casings--using flow turning. In this process, a core rod is used to cold form, weld-free, a short, thick pipe into a long, thin one, because only in this way can the extreme degree of precision and high degree of stability be achieved simultaneously. Although MAN does have experience with this technique, it is "utilizing it to this extent for the first time in Europe," Laussermair says proudly.

In comparison, another high temperature material used for rocket boosters has a long road ahead of it in terms of terrestrial applications: ceramics reinforced with ceramic fibers could make engines more heat-proof and thus more efficient, meaning that the cooling system could be cut in half, which would save in overall design weight.

Even more progress has been made in transferring DFVLR know-how in the area of carbon fiber lightweight construction from the space industry into automotive technology. As Dr. Juergen W. Beck, head of the DFVLR space division, proudly reports, the research institution is preparing "for the production, together with Daimler-Benz, of engine components such as crankshafts, piston rods and piston pins made out of carbon fiber composite materials."

MAN chairman Laussermair admits that all of these new products and methods "could have been developed without the detour via the space program. However, it is necessary to mobilize top talent, and space travel is the most suitable means for focussing on extreme demands," he believes. "In a free, classical market economy, many basic developments would never be paid for. It's like in tennis: With a star like Boris Becker, it is easier to get people active in popular sports. However, no one has ever become a top athlete by simply watching; it requires hard, persistent training."

It is precisely in this dilemma that the industrial exploitation of space laboratories is currently caught up: they have no Boris Becker, the great challenge--as the U.S. moon-landing program was at one time--or even better, the big scientific breakthrough. When this does come, however, it could be too late for the irresolute to make up for the technological advantage of the pioneers.

"A strategic decision is required, and for that entrepreneurial far-sightedness and feeling are needed," emphasizes Kienbaum consultant Ralf-Peter Thuerbach. Because even though MBB board member Othmar Heise has a list of around 25,000 West German firms in chemicals, glass and ceramics, electrical engineering and electronics, precision mechanics and optics, iron and metallurgy that are "conceivable beneficiaries," a clear calculation of return on investment is not yet possible, much to the discontent of industry.

Prof Dr Juergen Poetschke of the Krupp Research Institute in Essen prefers the use of space as a learning facility, rather than as a workshop, "wherever possible." In the case of the ambitious million-mark project supported by BMFT known as "Osiris," run jointly by Krupp, MAN, Daimler subsidiary MTU, Thyssen and the Rhenish-Westphalian College in Aachen, it admittedly "looks right now as if production is only possible under conditions of zero gravity." The project involves more heat-resistant--and thus fuel-conserving--

monocrystal turbine buckets, which are recast from a preformed polycrystal component outside of a container, only with an oxide ceramic support lining.

"With luck, we will be able to produce a nice, single unit by the year 2000." At the present-day price of DM 10,000 for a turbine bucket measuring five centimeters in length, the improvement in effectiveness could justify expensive production in space--presumably on free-floating automated platforms, the most economically feasible means for ongoing projects.

Only more experiments will create any amount of certainty, and it is in this sense that Poetschke feels limited by "the lack of opportunity for continuous experiments in space." There is a reason for Poetschke's impatience: He knows only too well that the development of earthly alternatives is also not standing still. "Eight years ago we thought that a perfect manganese-bismuth alloy that can only be produced under microgravity was very promising. The experiments also went great. Now, however, there are comparable magnetic substances on the market.

Nevertheless, consultant Thuerbach sees in the temporary cancellation of Shuttle flights no reason to hesitate in our own commitment to zero gravity research. On the contrary: "The delay gives us the opportunity to make thorough ground preparations and to test our formulations in short-term experiments--on parabolic flights with jet aircraft or high-altitude rockets, or even with special balloons." In this way, the user can slowly feel his way ahead.

According to Thuerbach, "only a few--if any--industrial space projects are far along enough for inclusion in a shuttle mission, to say nothing of a space station." And the lead time for a shuttle experiment is generally at least 3 years.

Despite the "expensive image" of space travel, the costs are, according to Thuerbach, "manageable" for users; the cost of experiments is "in principle to be calculated just like normal research projects." Additional expenditures are caused primarily by integration into a manned space vehicle, because of the limited space available and the safety requirements. As far as transport costs are concerned, decisive entrepreneurs can strike a deal, thanks to governmental financial aid. The Ministry for Research and Development gives 30 percent of the capacity of the D2 Spacelab mission to domestic industry, in order to provide an equal opportunity compared to similar arrangements between NASA and the U.S. competition.

Industry experts fear that ideal conditions of this sort will not exist for much longer, due to the growing load of U.S. and European programs for the future. And Japanese trading firms are already prepared to pay high entry fees in order to quickly get hold of a place for materials experiments in the ESA compartment of the D2 Spacelab mission.

Indeed, the scientific gains made by the Germans have served to rouse the foreign competition rather than interested parties in the FGR. "It is a tough process," Access [Aachener Centrum fuer Erstarrung und Schwerelosigkeit e.V.--Aachen Center for Solidification and Zero Gravity e.V.] chief Stephan Rex

says, complaining of the reticence of the clientele, even though a number of private and public mediation, consulting and service organizations have recently begun to pursue this clientele.

And while the large protein crystals grown by Freiburg scientists in space inspired hectic activity by U.S. and French pharmaceutical companies, MBB board member Heise was forced to implore the West German pill industry as late as at the beginning of 1986 "to pick up the potential know-how available at German colleges in the area of protein research under microgravity."

This appeal at least got through to Hoechst AG: The Frankfurt chemicals firm will participate in the D2 mission with a "very targeted experiment of this sort"--ultimately in order to "better synthesize" the substance on earth.

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HERMES PREPARATORY PROGRAM, CONTRACTOR ASSIGNMENTS ANNOUNCED

Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 445/446, 20 Dec 86 pp 14-15

[Text] Work on the preparatory program for the European spacecraft Hermes has begun following the confirmation on 27 November of contributions covering 70 percent of projected costs (48 million ECU). The target of the preparatory program is to achieve a precise definition of the spacecraft and of the related ground facilities, as well as to set the conditions for technical content, schedule, and financing terms of the development program. The ESA [European Space Agency] is responsible for the overall direction of the program. Under the supervision of ESA, the French National Space Studies Center, CNES, is directing the planning of the spacecraft and the directly related ground facilities, which is to be carried out by European industry.

The tasks connected with carrying out the program have been assigned as follows:

1. Aerospatiale is the prime contractor. The Marcel Dassault Avions company (AMD-BA) was given responsibility for the aerodynamic construction. Other European companies will participate in the tasks as main contractors.

2. The work on the various Hermes subsystems has been assigned as follows:

--Power	MBB (FRG)
--Electronics	MATRA (France)
--Onboard power supply	ETCA (Belgium)
--Fuel cells	DORNIER (FRG)
--Heat protection for reentry	AMB-BA (France)
--Guidance and control of the craft in the atmosphere	AMB-BA (France)
--Manipulator arm	FOKKER (Netherlands)
--Temperature regulation	AERITALIA (Italy)
--Environment control and life support	DORNIER (FRG)
--Data recording and communications link	ANT (FRG)
--Onboard software	AEROSPATIALE (France)
--Air lock module	CASE and SENER (Spain)

These contractors will consult other companies, such as AEG (FRG) ALCATEL-ESPACE (France), BTMC (Belgium), SELENIA (Italy), SEP (France) and SPAR (Canada). The precise participation of British industry will be established shortly.

3. During the preparatory program, individual contracts for the cell and equipment will be announced. The final industrial organization will include companies of the 13 ESA member countries and Canada which have all expressed interest in participating in the HERMES program.

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NEW HANNOVER FIRM TO PRODUCE PROTEINS, ENZYMES

Duesseldorf VDI NACHRICHTEN in German No 48, 28 Nov 86 p 32

[Article by Ulrich Eggert: "Cell Cultures for the Pharmaceuticals Industry: Biotechnology in Lower Saxony--Large-Scale Technical Production and Research Planned"; first paragraph is VDI NACHRICHTEN introduction]

[Excerpts] Hannover, 28 November (VDI-N)--The Invitron Corporation, a subsidiary of the American Monsanto Company, is establishing a branch in Hannover's Medical Park. Beginning in 1987/1988, this subsidiary will produce primarily proteins, enzymes, and cell cultures.

This biotechnology enterprise specializes in pharmaceutical products. Thus, among other products, a substance to coagulate the blood of hemophiliacs will be produced in Hannover along with another drug with precisely the opposite effect. With this, a blood clot in the blocked veins of a thrombosis-risk subject can be dissolved.

In addition to large-scale technical production of high tech pharmaceutical preparations, a considerable amount of research will be carried out here. According to Peter M. Stein, the 26-year-old vice president of the company, this factor was decisive in the choice of the Hannover location. Although several federal states and cities vied for the favor of being chosen by the pharmaceutical concern as the production location, the Lower Saxony City won the prize.

By way of justification, Stein noted: "Nowhere else did we find such an environment of biotechnological research institutions as here. Right next to us is the School of Medicine, which enjoys an excellent reputation internationally, the Fraunhofer Institute for Monoclonal Antibodies, the School of Veterinary Medicine, and other facilities. Braunschweig is not far away, with the Society for Biotechnological Research (GBF), the nearby Agricultural Research Establishment, and the city university, which is also well known. There is also Goettingen with two Max Planck societies. The surroundings seemed so favorable to us that we even rejected better financial offers."

Together with Goettingen and Hannover, Brunswick has been identified by the federal government as the national center for biotechnology. Along with microelectronics, this science is considered to have the greatest future prospects.

Microelectronics Has High Value

Both fields, biotechnology and microelectronics, already complement each other. Dr Karl-Heinz Narjes, the vice president of the EC Commission, in his opening speech at the Biotechnica Hannover '86, emphasized the importance that microelectronics has for biotechnology. The latter requires highly developed information technology, a network of databases and computer centers and specialized computer programs or artificial intelligence. It is in these surroundings--with a total of 7,000 sq m--that the 150 scientists working at Invitron will be able to dedicate themselves to their tasks. However, before they can begin their activities, Invitron managers have arranged a 1-year training stage in the United States. The future employees, who are to be brought together from throughout the European Community, will then be prepared at the parent company for thier work in Hannover.

Stein estimates the investments for the building, together with its equipment, at DM90 million, of which a good one-third will be contributed by the federal state of Lower Saxony and the city of Hannover. However, at Invitron it is thought that the costs will be covered only in the medium term. In Stein's opinion, biotechnology is handicapped by the fact that research tasks are long and expensive. Profitability only comes to bear when a developed product has also passed all the hurdles of the Federal Health Authority and similar organizations, and experience shows that this is a long road. Nevertheless, Invitron managers are satisfied with the strict legislative conditions in the FRG since, unquestionably, these are essential for a research field like biotechnology which, in many respects, is not without its dangers.

However, here in Hannover there will be no manipulation of genes or work on biological weapons, Stein assured. This is expressly forbidden. Furthermore, the firm has declared that it is prepared to accept further controls over its laboratory work in addition to the conditions imposed by law. The only objective is the pharamceutical sector, which is at a very high international level in the FRG.

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EUROPEAN TRANSONIC WIND TUNNEL TO REPLACE DNW IN 1993

Hamburg DEUTSCHES ALLGEMEINES SONNTAGSBLATT in German No 3, 18 Jan 87 p 13

[Article by Wolfgang Engelhardt: "The Big Simulator on the Polder"]

[Excerpts] In mid-1976, the Dutch space organization NLR [National Aerospace Laboratory] and the German Aerospace Research and Testing Institute (DFVLR) reached an agreement on their rather similar designs for a new, large wind tunnel; after years of construction difficulties and at a cost of DM 120 million, the wind tunnel began trial runs in 1980.

Now, the airplane industry has discovered the outstanding capabilities of the German-Dutch Wind Tunnel (DNW), especially Airbus Industries. But even Boeing and NASA are making use of the super-blower.

For the future, difficult tests by the Americans are scheduled for the wind channel; they want to try out their new prop-fan motors, which are especially difficult to handle, both aerodynamically and in particular acoustically. The Europeans have signed up with the new Airbus models. In the more distant future, it is expected that the subsonic flight test for the European Hermes orbital glider will be carried out at DNW, although the ESA engineers will have to switch to other wind tunnels for the supersonic and hypersonic glide tests.

In terms of technology and organization, the German-Dutch Wind Tunnel facility is the precursor of the planned new European Transonic Wind Tunnel (ETW), which is to be built in the Porz section of Cologne, on the grounds of the DFVLR, by 1993. The new tunnel will cover a range in speed of 450 to 2,000 kilometers an hour, thus linking up directly to the working range of the DNW. One important feature of the new so-called cryogenic wind tunnel is the sharp cooling of the air current used in order to reduce resistance on the test model, which can be studied in a field measuring 3 by 3.4 meters. Four countries are participating in the European Transonic Wind Tunnel: in addition to the FRG and the Netherlands, France and Great Britain are also joining in. Construction costs are estimated at around DM 500 million.

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BRIEFS

FRG FUNDS FOR AIRBUS--The German Airbus company was founded by the [aviation] industry to permit financing of the considerable allocations necessary for the production of the Airbus program and to obtain the necessary bank credits with federal guarantees. At present government-secured credits of about DM2.7 billion have been opened. The risk of this financing has always been considered particularly high since the Airbus program must penetrate the market as a new product and, furthermore, because it depends on the dollar exchange rate. Because of the drop of the dollar and the increased price competition from other aircraft manufacturers, a considerable deterioration in the Airbus program's financial situation has taken place in recent months. However, the federal government is still backing the Airbus program, as the Ministry of Economics announced in a press release. According to industry forecasts, the government expects no funding problems in 1987. It expects that the necessary new agreement for the Airbus program financing can be prepared in a timely manner for the 1988 federal budget and subsequent years. Even the industry itself, which can open further credits up to DM3.1 billion with federal guarantees, has not announced any additional requests for the 1987 federal budget. [Text] [Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 445/446, 20 Dec 86 pp 21-22] 8613

CSO: 3698/M152

KRUPP ELECTRONIK CEO OUTLINES PROCESS CONTROL COMPUTER, R&D

Frankfut/Main DIE UMSCHAU in German No 12, Dec 86 pp 606-609

[Interview with Dr Eng Karl Friedrich Triebold, chairman of the Krupp Atlas Elektronik Company of Bremen, FRG by staff reporter Heinrich Buecken; date and place not given; first two paragraphs are DIE UMSCHAU introduction]

[Excerpts] The Krupp Atlas Elektronik Company, with 3,000 employees, is one of the FRG's most important manufacturers of process control computers and is the only German company with a complete line of process control computers resulting from its own development and manufacture.

Both at the national and international level, the Bremen company is widely recognized in the area of guidance and simulation systems controlled through process computers as well as control consoles for municipal utilities, supply and waste disposal companies. In addition, Krupp Atlas Elektronik is active in onboard naval electronics and military engineering. Sales have grown by 15 to 20 percent annually to more than DM500 million in 1985, underscoring the success of this company.

UMSCHAU: Dr Triebold, the process control computer is like a leitmotif for all the activities of Krupp Atlas Elektronik. You manufacture simulation systems, sonar systems, and you are going into mainframes. The process control computer is always involved. Where and how do you determine the main R&D priorities in your company?

Triebold: In comparison with the giant enterprises in our field, we are a relatively small company. Our sales amounted to about DM500 million in 1985. Naturally, this means that we have to plan the priorities of our R&D activities very precisely. When you talk about simulation, sonar or mainframe technology, you talk about areas we master and which are linked by certain factors, but must be seen in completely different ways.

An example is SUPRENUM, the supercomputer for digital applications which is to be developed at the request of the BMFT [Federal Ministry for Research and Technology] in cooperation with industry, large-scale research institutions, and universities. This research is directed at and has potential for the future in the sense that efficient computer systems are required for technical, physical, and particularly for the scientific tasks of today and tomorrow.

If we want to compete with international R&D, we need our own computer systems as long as high efficiency does not always result in high prices. Various considerations led to the current approach of developing this German supercomputer in parallel technology. And with this key word I would like to switch to the activities of our company here in Bremen.

Today, as in the past, the needs of our customers become more demanding from day to day. This means that we have had to develop and manufacture our own computers in order to remain competitive. Today we are in a position to develop and produce operating systems in addition to both hardware and applications software.

We became involved relatively early in projects in which the computer or data processing center had to achieve very high speeds to cope with the requirements of a process. For this reason we manufacture process control computers as components of our various products and systems.

UMSCHAU: Are you self-sufficient as a developer and manufacturer of computer systems? Do you do everything in house?

Triebold: Yes, we produce everything ourselves, the computers, the necessary operating software, and the applications software. But, unlike IBM, we do not supply process control computers to other market sectors. As I said before, we need this equipment for our products and systems.

The turbulent computer development in the last decade inspired us, and then the requirement for reliability arose along with the requirement for fast, efficient process control computers for different tasks.

Already a few years ago we marketed the synchronous duplex computer which had a reliability factor of 99.9 percent. Then we started to connect the elements of reliability and speed, leading to the so-called parallel computer. At the Hannover fair in 1983, we were the first company ever to market a working multiprocess computer.

UMSCHAU: But are these supercomputers manageable yet for human beings?

Triebold: You mentioned simulation systems at the beginning. We delivered the first civil ship guidance simulator in 1982, the SUSAN ship guidance and simulation installation, put it in operation, and turned it over to the maritime department of the professional university in Hamburg on 3 September 1982. T is installation has now been in operation for more than 4 years. At one point we calculated the computer capacity that was installed there and came to the astonishing conclusion that we had already developed in 1982 operational computer systems that have been in continuous operation since that time, and that have a capacity that is 70 percent of the modern American mainframe computer which was recently set up at the university in Stuttgart.

This system can be operated by a single person, if necessary. To put it very clearly: When the correct connections are contained in a properly designed man-machine system, this modern technology can be fully "handled"

by a single human being. With reference to reliability, such a system on which future merchant shipping officers are trained cannot and must not malfunction after 10 minutes of operation. Such a simulator must be fully operational for at least 2 shifts a day--day after day--in order to guarantee continuous training. Overall, we have dedicated a lot of thought to these questions--reliability and manageability--so that the machine does not handle the human being, but the human being operates the machine reasonably and efficiently. This also means we consider ergonometric elements in all systems planning.

UMSCHAU: What are the possible applications of such a supercomputer?

Triebold: I must repeat what I said initially, that we are talking about parallel computer architectures. This supercomputer is to be employed for the solution of technical-physical problems, for example, in meteorology and in fluid mechanics, or to display sequences, or functions in combustion engines. That is a first possible application.

It should be mentioned at this point that such a project does not necessarily lead to a risk-free approach, even with the cooperation of universities, large-scale research institutions, and industry. All the participants, whether in hardware or software, must provide intensive and considerable research efforts until the goal is achieved.

UMSCHAU: You manufacture simulation systems for power plants and nuclear power plants to train operating personnel. You have also proposed to simulate emergencies in such systems in order to ensure still more safety. Does this constitute an opportunity for nuclear power?

Triebold: The thought may be expressed as follows: Let us assume that it is possible to realistically simulate nuclear power plants in a mathematical model like other industrial processes. Realistically means that all functions are known in their mathematical constants and also in their interdependencies. If this is the case, certain acceleration factors can naturally be obtained by using high computing speeds. You know that space flight trainers or simulators have been used, for example, to practice landing on the moon without having been there. If it is also possible to carry out a pre-simulation through an acceleration effect--based on the premise of what happens if, for example, case 1, case 2, and case 3 occur in any combination in a nuclear power plant--then a complete, entirely simulated result could be achieved. Based on real time constants in the power plant, reaction times would also have to be available in order to make correct decisions in time. This is one route; I think it is worth looking into. The immediate second thought is as follows: Today we all talk about "artificial intelligence," about expert systems in which the knowledge of various experts is stored in order to make this expertise available to others. Now you can imagine that if such simulations were run in different combinations and fed into an expert system, we would obtain still shorter reaction times. This is possible from an engineering point of view.

We already manufacture simulators for the instruction and training of the operating crews for conventional and nuclear power plants. Here we work with real time constants because the operating crew is also bound to these real time constants and must draw their conclusions accordingly. I merely want to point out that the generation of these mathematical models has reached a point where they are true to reality. Therefore, I asked myself when the discussion about Chernobyl and general safety came up: Why are the aforementioned methods not used and how much additional safety would they bring? The last point must be examined. Applying a little fortune telling, I would like to draw the cautious conclusion today that in the field of reactor safety a lot can still be done, especially in the connection and use of expert systems. The solutions are then not only valid for us in the FRG. A common European association should be created to substantially improve the existing security and in this way decrease the current polemics. In this connection there also the question of whether all this can be afforded. Recently, this has been discussed very extensively in the media, and in this context certain figures have been quoted which now are going to be reversed by the KWU [power plant negligible in relation to the total cost of a reactor system.

UMSCHAU: Has the emergency simulation already been created?

Triebold: Yes, but with real time constants. They are part of the systems we have manufactured and which are ready for acceptance tests. They are feasible.

UMSCHAU: You are a subsidiary of the Friedrich Krupp company. How much influence does the parent company have on your R&D activities?

Triebold: We are a wholly owned subsidiary of the Friedrich Krupp company, but in a legal sense we are an independent company. We make strategic plans for a period of 10 years. The operative planning is derived from this strategic planning which also determines the R&D objectives. It is obvious that there are various levels: What do I need immediately? What do I need in the medium term? What do I need to be doing today in order to prepare certain trends for the future so that I am on the market on time, with the right product, the right system?

Strategic planning is coordinated with the parent company. The Friedrich company is a holding company, that is business activity is the responsibility of the companies that are active on the market, and we are active as the so-called subsidiaries. Given this fact, the responsibility following a completely coordinated process is entirely on our shoulders. We are responsible for reaching our goals within the specified timeframe.

UMSCHAU: For the development of the SUPRENUM computer and also for other projects you are subsidized by the BMFT. Does this bother you?

Triebold: We are not one of those companies which claim BMFT subsidies whenever possible. When the federal minister of research subsidizes areas of technology or target areas which do not concide with our own company

strategy, we will not even bother to apply for these funds. In order to serve a common cause, there must exist clear synergy between the goals of the BMFT and our own objectives.

Today I can say that there are areas where we have reached an equal footing with the rest of the Western world in product technology. And I would add that in March 1984 we were the first company in the world to receive a license from the German Hydrographic Institute for daylight radar with raster scanner display. It was only this year that our competition brought comparable equipment to the market. The second example I would mention is that we succeeded even without great experience in manufacturing competitive simulators on our own. The real time computer-generated imaging systems which require a considerable computer performance are also part of this.

The third example would be the parallel process computer which we also presented as the first German company at the Hannover fair. Today, an almost worldwide boom has erupted in the field of parallel processors. To return to your question: When it fits our orientation, and is therefore with advantageous to both parties--our funds benefit the BMFT and the high standard of German technology and vice versa--then I am of the opinion that subsidized R&D brings considerable advantages for both parties.

UMSCHAU: With regard to the subject of "long term planning:" How far ahead do you have to think? I would imagine that for the development of such systems even a period of 10 years is still too short.

Triebold: I can only agree with you. If at all possible, one should think farther into the future. We too try to do this. I would like to illustrate this to you. If we start from the fact that we have innovation rates of from 2 to 5 years, then we have a horizon of about 10 years which, in one way or another is linked to the development of components. We must examine and figure out where such development will lead, particularly with the question in mind: What is the overall trend in development and manufacturing processes? Two fundamental routes stand out very clearly. One is in the direction of large-scale series production, which includes, among others, the automobile industry, and parallel to this is the second route which leads to lower quantity but higher intelligence. We have chosen the second route. This means that we have to anticipate today what will be desired 15 or 20 years from now. Already today we concentrate certain research activities on this. In addition, worldwide development must not be forgotten. It must be observed very closely, because from certain starting efforts something completely different could develop in 10 years. To mention only one example in this connection--in some of today's approaches we are already discussing biologically structured computers.

UMSCHAU: Regarding the worlwide view: How do you judge the competition from the United States and Japan, especially in the area of computers?

Triebold: First of all, we must consider one thing: The funds employed in the United States and Japan for the development of new computer structures are incomparably greater than those employed in the FRG, maybe

greater than those employed throughout Europe. You know what critical mass means, and I believe that we must succeed as Europeans or Germans in reaching the critical mass for this development. Now you should not fail to recognize that certain peoples and ethnic gorups handle intelligence with certain special characteristics. Based on our educational system, it can be stated for Germany that the combination of different scientific disciplines-- not just specialized knowledge--represents an outstanding feature in the education of our engineers. That means that this combination theory which in reality today has also lead to expert systems, represents an outstanding characteristic of our own efficiency. And therefore I believe--Iremind you of the Spacelab and Airbus programs--that also in other fields comparable success can be accomplished, in fact, must be accomplished. We regret that the scorn for natural sciences in the past 15 to 20 years will bring us considerable resource problems in the foreseeable future, especially in the areas of electronics and computer science. Through appropriate continued education we must prepare training programs for our employees in order to avoid future problems.

UMSCHAU: How is your cooperation with technical universities? Can you still obtain today you junior technical staff without problems? Does the educational level correspond to the requirements of this company?

Triebold: In the FRG, there are still areas which are by no means adequately covered in university training. This includes the whole discipline of hydroacoustics where we participate in work on fish detecting systems, depth finders, and doppler navigation equipment. Up to now very little has been taught in this field in Germany. We work predominantly with communications engineers and physicists who have trained themselves in hydroacoustics or who have been trained by us. In other areas, for example, electronics and computer science, we are quite satisfied with the way training is handled in professional schools and technical universities. However, that does not mean that our new employees do not have to receive additional training in our company. Here they are part of a larger environment and technical qualifications alone are not sufficient; notions of management and cooperation must be added. In this respect, we offer our employees continued technical education as well as additional management courses.

At this point I would like especially to stress that as an industrial company we are interested in cooperating with universities and technical schools in all areas where we can still learn from them. I myself recommend that teaching and research come out of their "ivory tower" and communicate with industry and vice versa. We should--as it was in part handled in Germany in the past--develop the American principle, that is, to fill university professorships with employees from industry and to give them limited contracts which guarantee a later return to industry.

Our cooperation with the universities and technical schools even goes to the extent that our employees can work on their degrees or in some cases even PhD theses in our company. In addition, we cooperate within joint programs with several institutes and take every chance to assign tasks we cannot solve ourselves right away to appropriate technical universities. That is not necessarily limited to Germany. Sometimes we also go abroad.

To conclude, I would like to mention one special aspect. Although we have talked about technology up to now, I must add that we make a major contribution to the improvement of safety and environmental safety with our daylight radar, our ship guidance and power plant simulators, and other systems. This is especially obvious in the stressful for the environment to learn ship guidance in a closed room, rather than navigating for a long period of time aboard a vessel. But this is not all, with comparable technology we have succeeded in considerably improving water supply, natural gas supply, remote heat supply, electric power supply and waste disposal for small communities and, to a certain extent, for large regions. What I am getting at is that modern technology creates ways and means of achieving something in real terms for environmental protection which could not be achieved with conventional methods. I think it is a task for all of us to employ new technologies today and in the future in order to create things important for man so that his life is more worth living and experiencing. This task must not be fought with the slogan "microelectronics equals job killer;" the reverse "microelectronics equals job creator" would be more reasonable and convincing, at least in our fields of activity.

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STATISTICS ON EUROPEAN ROBOTICS, FMS USE

Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German
13 Feb 87 p 7

[Unattributed article: "Europe Must Catch Up in Robots and Automation"]

[Text] Brussels (VWD)--Compared to the United States and Japan, the use of industrial robots and flexible manufacturing systems (FMS) in Europe is still in its infancy. In the case of robots, even the Federal Republic, the leading nation in Europe, has only 1,800 compared to 17,900 in Japan and 5,500 in the United States. The European countries' need to catch up is not quite as pressing in the case of flexible fabricating systems, as all the European OECD countries have an estimated 100 such installations at their disposal while Japan has only 80 and the United States 40. This is evident from analyses which the Fiat subsidiary Comau SpA in Brussels has produced. According to them, the world market for industrial robots has developed as follows since 1984:

Country	Robot Units Sold	Value End of 1984	Predicted Value for 1990
Japan	17,900	546	1,250
United States	5,500	306	1,150
Germany	1,800	118	350
Great Britain	870	33	130
France	1,370	66	200
Italy	1,090	48	150

(Values in millions of U.S. dillars)

According to Comau estimates, world inventories will increase by twentyfold:

Use	1980	1989
Units	(12,000)	(250,000)
Welding	48 percent	20 percent
Packing	27 percent	32 percent
Installation	5 percent	33 percent
Miscellaneous	20 percent	15 percent

Comau presented the following regarding the growth of FMS inventories of the most important OECD countries (number of units):

Country	1985	1990
Germany	28	70
Great Britain	25	35
France	15	45
Italy	12	30
OECD Europe	100	230
Japan	80	220
United States	40	150

A breakdown by usage shows clear differences between Europe, Japan and the United States (amounts in percentage):

Sector	Europe	USA	Japan	Total
Transportation	45	24	14.7	28
(Automobiles, motorcycles, trucks, ship and aircraft construction components)				
Mechanics	35	73	78.0	63
[Agricultural machinery, earthmoving machinery, manufacturing installations, engines, transmissions, compressors)				
Electromechanics	10	3	4.9	6
Electronics	10	no data	2.4	3
Total	100	100	100	100

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SIEMENS GREY LEVEL SENSOR RECOGNIZES SUPERIMPOSED PARTS

Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German
2 Feb 87 p 7

[Article: "Robot Recognizes Superimposed Parts"]

[Text] Frankfurt--Robots can recognize various objects--even under varying conditions of contrast and when they are superimposed upon one another--by means of a process developed by Siemens AG, Munich and Berlin. Not only can the relative position of the part in relation to the camera be recognized, but whether these parts touch each other or whether the parts have been positioned to overlap each other at angles of up to plus or minus 20 degrees. The concept of the "grey level sensor" is based, according to the firm's account, upon an analysis of geometric edge characteristics such as circles, straight lines and corners. In addition, surface characteristics such as grey value differences among surface elements are also registered. Thus, from the television image a list of geometric characteristics which are contained in the picture and which are compared with component modeling data stored in a library, is developed. But only those parts are recognized which, according to the library entry, can be found at the robot's respective work station.

According to Siemens, the system can recognize 68 different parts under varying illumination. The duration of the recognition process depends to a great extent upon the number of characteristics required for an unambiguous description of the part in question, and also upon the number of characteristics which are located in the camera's field of vision. While for simple tasks 0.5 seconds is sufficient for recognition, it could take up-to 2.5 seconds in cases involving many characteristics. The local position of the parts is precisely registered on about 0.1 percent of the image field area and the parts' orientation is determined to exactly 1 degree. The speed of part recognition attained already permits a multitude of applications in manufacturing, especially in machine loading and equipment assembly. The firm hopes that part recognition will become even faster with the increasing speed of data processing.

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MAX PLANCK INSTITUTE STUDIES APPLICATIONS OF LASER CHEMISTRY

Duesseldorf VDI NACHRICHTEN in German No 46, 14 Nov 86 p 37

[Article by Egon Schmidt: "The Laser as a Tool for the Chemist"; first paragraph is VDI NACHRICHTEN introduction]

[Excerpts] Garching, 14 November (VDI-N)--In materials research corrosion protection, production of highly integrated electronic components as well as other fields, a large number of methods are used which could not be utilized without surface layers with very particular material properties. Laser-based chemistry now opens up completely new prospects: The tightly bundled light ray can be exploited not only as a source of energy but also as an analytical or diagnostic measuring aid.

Fascinating insights into modern laser chemistry techniques were given at a press conference in Garching, near Munich, by Professor Ludwig Kompa, director of the Max Planck Institute for Quantum Optics in Garching. The institute, which recently received a rather imposing new home, architecturally speaking, deals on a broad front with the many possibilities of exploiting modern laser techniques, of which laser-based chemistry is but one. Certainly it is one which, in Kompa's opinion, "can bring many applications."

Laser Induced Material Separation of Metals

At present, as was explained in Garching, scientists "are just investigating the fundamentals" of the future techniques presented here. They apply methods that they have borrowed from other fields of laser-based chemistry and laser spectroscopy; for example, certain molecular beam techniques and surface dispersion methods.

Thus, in Garching there is already a small molecular beam apparatus, which is used to measure directly the energy transfer occurring during a surface collision. Experiments are being undertaken; as Kompa explained, which are significant "for laser-induced material separation methods" and by which metals are presently being processed in Garching.

An additional experiment carried out by the scientists of the Max Planck Institute represents, so to speak, a preliminary stage of nickel refining. It is possible to observe during this experiment how the volatile nickel tetrocarbonyl metal compound disintegrated "into a very bright molecular fragment" after being excited by the laser. In this case, an excimer laser working only in an ultraviolet field is used.

Another interesting field of laser-based chemistry concerns new, particularly cost-effective methods of isotope separation. In this context it must be clairfied in advance that isotopes can only be separated with great difficulty using conventional methods since they have almost identical chemical properties and differ from each other, for the most part, only in their mass.

However, spectral differences also exist between isotopes; and they are now being used in Garching in order to "excite an isotope selectively" with the laser. Thus, it is possible, for example, to excite and dissociate the carbon-13-isotope from freon $CHClF_2$ in a controlled way with a carbon dioxide laser; this isotope occurs in nature only 11 times per 1,000 carbon atoms.

A product of this laser treatment is the composite C_2F_4 with the desired isotope. This composite can be separated by distillation. According to the Max Planck Institute, this is then "oxidized to CO_2 in a microwave discharge for further use." Ninety-nine percent of the freon can be sent back to the producer after the desired rare isotope has been separated.

Selective Excitation Separates a Good Many Isotopes

Isotopes are used in many research applications. An artificially altered isotope composite with, for example, more than 11 carbon-13-isotopes per 1,000 atoms can be used to track the movement of a chemical composition through multiple chemical reactions.

This could be important for studying the environment as well as biological processes and medically significant phenomena.

It is important in a laser chemical method like the one described here that the selective excitation of the desired isotopes occur in a very short time. Otherwise, energy would transfer collisions between the isotopes, resulting in the loss of the selectivities, which are crucial to success.

In Garching as in other laboratories, carbon-dioxide lasers have always been used previously to produce short high-speed flashes. These lasers "were excited by a fast pulsed discharge." However, because this type of laser only offers a short life span, producing light impulses in this way is expensive. The process would be much cheaper if carbon dioxide lasers with a longer-lasting discharge could be used.

The thought of the cost reductions possible here would not let the economy-minded Max Planck quantum opticians rest, so in the end they created an "optical switch" which they built into a sustained light laser. It is formed by a rotating apertured disc. Now there is a well founded hope that the costs of the laser light and, as a result, the costs of the isolated carbon isotopes "can be reduced drastically."

If these isotopes actually become cheaper, thanks to newly developing production techniques or a better separation technique, one can expect that many new fields of use will be found. They could be used, for example, in medicine to observe the functioning of certain organs with the help of the well-know nuclear spin tomography. If everything works out as Kompa and his colleagues expect, the Garching lab equipment will soon be able to produce 10 to 20 grams of isotopes per day, a quantity that would equal about one-third of world production.

FRG FIBER OPTICS DEMONSTRATION TESTS HDTV PRINCIPLES

Duesseldorf VDI-NACHRICHTEN in German 2 Jan 87 p 11

[Article by Claus Reuber: "The Same Picture Quality on the Home Television As at the Cinema"; first paragraph is VDI-NACHRICHTEN introduction]

[Excerpts] Berlin, 2 Jan (VDI-N)--A demonstration was made early in December in Berlin of how future high-definition television may look with a fiber optic transmission from Sender Freies Berlin (SFB) [West Berlin television station] to the Heinrich Hertz Institute (HHI). Upon the completion of the development work, the viewer should experience a television image with about double the lines and eight times as many pixels as at present. The quality should then be equivalent to that of a movie film and offer the eye large format flicker-free and line-free TV images.

On 11 December, 50 viewers saw the German premiere of an HDTV [High Definition Television] image that was produced by a video projector and delivered via signals from a fiber optics transmission cable.

The demonstrated process increases the number of scanning lines from today's 635 to 1129, the number of pixels grows by about a factor of eight to 1.6 million, and the image production rate increases from 50 to 60 per second, freeing the image from flickering. During the Berlin demonstration, the images projected had a diagonal size of 3.5 m while the quality was roughly equal to that of a projected transparency.

Data Transmission Rate Until Now Has Been Far Too High

The test cable for the digital transmission of HDTV signals used a monomode optic fiber and a data transmission rate of 864 Mbit/sec. The cable is part of an experimental system that so far is the only one of its kind in Europe. It is being developed by the HHI with funds from the Federal Ministry for Research and Technology (BMFT]. The further development of transmission technology and of large screen image reproduction are among its objectives. For example, work is being done on reducing the data to one-third of the capacity currently used. Furthermore, a wealth of experience on the possibilities of use of the new HDTV medium in program production can be obtained through continuous HDTV presentations in the form of a small electronic cinema, in cooperation with SFB.

Experts from the HHI and the BMFT said that equipment for use in the home will be on the market in 10 to 15 years at the earliest. At the moment, they said, it is a matter of first obtaining technical communication [standards] in studio technology. According to an HHI representative, it is hoped that technical standards will be developed in 3 years, followed by the production of equipment for the home.

HHI has been working on HDTV problems since 1981. A research and development contract has been awarded for the development of a suitable camera, while the problems of transmission and reproduction are being confronted in-house in Berlin. In order to successfully introduce HDTV, the availability of high resolution large-scale display units will be of crucial importance. The desirable image field dimensions with a diagonal of between 2 and 2.5 m will be possible in the near future only with television projection, HHI confirms.

While for the premiere a Sony projector was used with three projection tubes for the basic colors--red, green, and blue--the HHI specialists are working on developing a projector using the principle of light valves. In this process, which was proposed decades ago, a control film, which can be thought of as an electronically generated transparency in the rays' path, modulates the light of a separate light source. In this way, light flow and resolution can be increased independently of each other, which presents problems in electron-ray image tubes.

The work undertaken by the HHI in Berlin is a part of "Measure No 16 of the Framework Plan of the Federal Government for the Promotion of the Development of Microelectronics, Information Technology, and Communications Technology," for which a total of DM60 million is available for 1984 to 1988. About one-third of this sum goes to Berlin.

The Projector Functions with Light Valves

On the occasion of the HHI premiere, Dr Joerg Sander of the BMFT compared the technological breakthrough expected in television in the 1990's to the change-over from black and white technology to color television in the 1950's. However, the introduction of high definition television will have effects that will go beyond the field of television itself, changing, on the one hand, film production and, on the other, the balance between cinema and television since the same image quality offered in the cinema will be available in the home.

As important reasons for the BMFT promotion, Dr Sander cited the situation in the entertainment electronics industry in Europe, the development of the fiber optics broadband network, and the pacesetting role that HDTV plays in electronics in general. He recalled the reduction of the number of people employed in the European entertainment electronics industry in recent years and their concentration in two sectors. Today's stagnating television set market can only be reinvigorated by a new television system. Sander also referred to the EUREKA project in which Bosch, Philips, Thomson, and Thorn-EMI are working on the development of new system standards.

The preliminary work of Japan's public broadcasting company, NHK, began in 1970 and has led to a quite well developed system with 1,125 lines per image, a half-frame sequence frequency of 60 Hz, and 2:1 line interlacing. For the remaining requirements, the technical characteristics of today's television were largely maintained, to the extent that this innovation appears rather conventional now in the middle of the 1980's. Still, Japan's leading position in establishing standards has enjoyed considerable influence in the formulation of a studio standard.

Nobody doubts that in the future high definition television production, transmission, and image reproduction standards can and will be different from one another. After all, the unified standards for each step from production to reproduction in traditional television's analog technology is already being abandoned gradually in the changeover to digital technology. The purely electronic problems that are inevitable in the process of changing standards may be solved relatively easily with microelectronics components. For example, the 216 Mbit/sec of the digital television studio standard recommended by the CCIR [International Radio Consultative Committee] does not fit any of the hierarchic levels of international broadband connections. That is why work is already being done to reduce bit rates for transmission standards to about 140 Mbit/sec or 34 Mbit/sec.

As is known, the decision on the HDTV production standard of the future was postponed for 2 years in the summer of 1986. The Japanese proposal for 1,125 lines and 60 half-frames per second is countered by the European proposal for 1,249 lines and 50 Hz. Yet is hardly likely that the 60-Hz countries will abandon their 60-Hz standard, which is superior in terms of the absence of flickering. The only thing remaining is the understandable desire to establish a "common superstandard" that would support international program exchanges and would be suitable for an easy changeover to various transmission and reproduction standards.

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FRG SCIENTISTS DISCUSS POTENTIAL OF SEMICONDUCTOR LASER

Duesseldorf VDI NACHRICHTEN in German No 46, 14 Nov 86 p 28

[Article by Claus Reuber: "Refined Structures in Semiconductor Lasers Lead to Increased Radiated Power"; first paragraph is VDI NACHRICHTEN introduction]

[Excerpts] Berlin, 14 November (VDI-N)--Increased radiated power at low threshold current, a sharp spectral line in resonant form, and a light beam with a thin directional pattern--these are the development goals concerning semiconductor lasers. Potential structures with increased minimum limits for charge-carrier injection in the active laser field and chip models with multiple laser stripes offer solutions for the tasks to be carried out by today's laser technology.

These tasks and development goals were discussed by about 50 experts at the exhibition of research results in the heterostructure/semiconductor laser field from 9 to 10 October at the Institute for Solid State Physics of the Technical University of Berlin, where the fall convention of the "solid-state/spectroscopy" study group from the parliamentary assembly of the European Council took place.

The semiconductor laser, also referred to as the injection laser because of its charge-carrier injection, is actually a very simple component which is already mass produced especially for compact disc players and the emerging light wave conductor communications technology.

Sequence of Layers Replaces Uneven Structure

At the Berlin Convention, Dr R. Engelmann of the Siemens Corporate Research and Support Inc., Princeton, reported on the production and possibilities of "multiple quantum wells," i.e., multiple potential structures. The active field, which in the conventional heterostructure laser currently in use is only a few tenths of a micron thick, and in which the stimulated emission of the laser light is maintained through a recombination of the carrier charge, is replaced by a sequence of separate layers. By alternating pure gallium arsenide, different intermittent energy gaps are obtained and, therefore, a multiple potential for the charge carrier, the so-called "quantum wells."

Increased Strengthening of Low Threshold Current

Englemann's report concerns quadruple gallium arsenide structures between 3.3 and 13.3 nanometers thick, with intermediate layers 70 nanometers thick. A laser with this quantum well structure excels because of increased amplification and lower threshold current. Engelmann's research shows, however, that too many quantum wells diminish this improvement; the optimum is probably between 3 and 6.

Professor Dr. E.O. Goebel of the Philipps University in Marburg examined coherence properties and nonlinear optical interactions in semiconductor lasers in his report. He mentioned the different bandwidths of radiation from monomode and multimode lasers. The bandwidth in Monomode lasers is between 10 MHz and 100 MHz; in multimode lasers it is approximately 1000 times higher, i.e., in the GHz range. In this case the theoretically calculable strong coupling of modes must be taken into consideration.

Goebel was able to test these observations using correlation-optic analysis. For this, equipment with a number of Fabry-Perot resonators was used, which are necessary for the separation of modes as well as for the analysis of the spectral lines of a resonant form. Here a strong correlation between the fluctuations in the amplitude of the different modes and also within a line can be observed. These results are clear proof of nonlinear effects in semiconductor lasers.

If many laser strips [Laserstreifen] are placed close together on a semiconductor chip, substantially increased irradiations can be reached. These possibilities were discussed in Berlin by Dr F. Kappeler of the Siemens Research Laboratories in Munich. While normal single-stripe lasers reach around 100 mW, he obtained a continuous wave power of 1.65 W with a 40 stripe laser. It consisted of a multiple quantum structure, which, to reach the aforementioned capacity, required a current of 6 amperes and which reached a maximum efficiency of 33 percent. With a less powerful multiple-stripe laser (0.68W), he reported, he even obtained a optimum degree of efficiency of 36 percent. The irradiations from the single stripes are coupled in a phase-locked manner.

Fourier Optics Replace Classic Lenses

A report on laser components for optoelectronic systems cane from Telefunken Electronic, Heilbronn. Dr H. Nather reported on the lense systems necessary for beam focusing, which he said must consist of at least 3 lenses in order to obtain optimal adjustment. However, future developments should bring about the transition from classic lenses to fourier optics, that is, to holographic optical elements, whose concentric circular slots [ringschlitze] replace classic lenses. This will lead to essentially simpler forms of laser components, which can also be used as components in integrated optics.

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SIEMENS INVESTS BILLIONS IN MEGABIT CHIPS, SUBMICRON LITHOGRAPHY

Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German
4 Feb 87 p 5

[Unattributed article: "Siemens Invests Billions in Megabit Chips"]

[Text] Munich (DPA/VWD)--Investments amounting to DM1.7 billion and DM800 million in research and development expenditures, as well as DM240 million in public funds, are going into the chip project with which the Munich firm of Siemens hopes to ensure itself a long-term leadership position in the world microelectronics market. In the firm's view, only those who, in synch with the innovation cycles in the microelectronics field, have the latest generation of technology at their disposal at the earliest possible moment, can successfully compete. In the field of electronic memory chips, this means a new component generation about every 3 years.

For Siemens that means, according to statements by Board Chairman Karlheinz Kaska, that the production of memory components is not the real strategic goal. Rather for the firm it is a matter of mastering submicron structures to such a degree that Siemens will be able to manufacture more and more logic components for the market and for its own products and systems in the next decade. The firm expects that fewer than six venders from the United States, Japan and Europe will share the chip market in the future, which, it is estimated by Siemens, will amount to a volume of DM400-500 billion by the turn of the millenium. Cooperation with Toshiba on the 1-megabit chip, and with Philips on the 4-megabit chip, should speed up the chip project.

For the present, it is a matter of the 1-megabit memory chip, mass production of which is to begin already in 1987 at the new Siemens Works in Regensburg. This chip requires a structural fineness of 1.2 thousandths of a millimeter and concentrates one million units of information on a silicon surface of 54 square millimeters. The volume of information which can be stored corresponds to 64 typewritten pages of text. Chip development, however, has gone far beyond that: Circuit testing of the 4-megabit chip, which is manufactured with more than 400 procedural steps, has already been undertaken. The first custom-designed models will supposedly come on the market in 1989. Siemens is already working, within the framework of a "submicron technology" composite project, on the use of x-ray illumination in semi-conductor technology to create the preconditions for the development of the 16-megabit and 64-megabit.

EEC DATABASE TO ASSIST R&D EVALUATION

Paris R&D EVALUATION NEWSLETTER in English 11 Feb 87 pp 5-6

[Article by Dr Luigi Massimo, EC Commission, 200 rue de la Loi, B-1049 Brussels, tel. (32.2) 235.66.49: "The Evaluation for R&D at the Commission of the European Communities"]

[Text] Although Community R&D spending only represents about 2% of national R&D expenditure in the 12 Member States, the Commission is conscious of the fact that Community programmes will always have to undergo a closer scrutiny than do national programmes, that is by twelve governments, by twelve parliaments, etc.... The fact that the Community programmes entail the spending of public money means that they must stand up to an evaluation of how effectively they are managed, how well they fulfil their objectives, whether they are relevant to the continually changing needs of the Community, and whether their funding at Community rather than national level is justified.

That is why, since 1978, the Commission has pioneered the regular evaluation of its R&D programmes as an integral part of their management. Evaluation is two-pronged. It includes internal evaluation by the Commission's research managers assisted by their advisory committees, and external evaluation by panels of independent experts. There have been some 20 of these, and their published reports (Footnote) (Available from the Office for Official Publications of the European Communities, L-2985 Luxembourg) have had a major influence on the continuation, alteration, or even termination of the various programmes.

In 1983 the Commission drew up a three-year Plan of Action for research evaluation, with an Evaluation unit to organize independent external evaluations. It has recently (November 1986) brought out a new and revised Plan to cover the next five years, and embrace the vast range of research activities that make up the so-callled "Framework Programme" (still being debated by the Council of Ministers). The new plan is much more ambitious and far-reaching than the earlier one.

It includes:

- the setting of milestones to be reached and verifiable objectives for each research programme;
- the systematic collection of all the data likely to be needed by the evaluators;

- the organization of external independent evaluations of each programme by means of experts and consultants. There will also be "horizontal" evaluations, of activities common to several research programmes;
- the dissemination and putting into practice of the results of the evaluations.

Evaluations will address numerous aspects of the research activities: scientific and technical achievements of the programme; quality and practical relevance of the results (including, whenever relevant, commercial aspects); effectiveness of the management and of the use of resources; the programme's or activity's contribution to the development of Community policies and to the social and economic development of the Community as a whole, etc.... Whenever possible, these evaluations will be based on quantitative indicators.

The Commission also proposes to carry out research on the best ways to evaluate its complex multi-national cooperative programmes and their social and economic effects. It will be compiling a database on evaluations and evaluators, and forming a Network to link its own Evaluation unit with similar units in the 12 Member States. This will allow the exchange of experiences and names of suitable evaluators, and help to spread best practice in research evaluation.

The Commission is pleased to salute the appearance of this Newsletter, and will be a regular contributor so as to keep readers informed about its activities.

CSO: 3698/A183-E

DEPUTIES HEAR TESTIMONY ON STATE OF R&D IN ITALY

Rome NOTIZIE AIRI in Italian Jul-Oct 86 p 14-16

[Text] Hearings on the state of scientific research in Italy conducted by the Inquiry Committee of the Chamber of Deputies continue. After having heard the presidents of CNR [National Center for Research], ENEA [Nuclear and Alternate Energy], and the Institute of Nuclear Physics, the committee continued the investigation with the testimonies of the general director of the Higher Institute of Health, prof Francesco Pocchiari; the leader of the IRI [Industrial Reconstruction Institute] study and strategies group, Massimo Ponsellini; the vice president of ENI [National Hydrocarbons Agency], Giancarlo Grignaschi; and Carlo Tribuno, in charge of technology research for EFIM [Manufacturing Industry Holding and Financial Company].

During the testimony Pocchiari explained to the parliamentarians the organization, the objectives, and the problems of the Higher Institute of Health which in 1984 celebrated the fifty years of its existence. The institute--said Pocchiari-- has a nucleus of 1527 workers, to which are added 350 Italian and foreign guests and scholarship holders, for a total of about 2000 people. The institute consists of 21 laboratories and seven technical service centers, and possesses the most important medical library in the nation. Among the problems hindering its activity Pocchiari emphasized the scarcity of funds for the Institute, which amounted to 2.5 billion [lire] in 1984, 5 billion in 1985, and an estimated 6 billion in 1986. If one compares these funds with how research funds are distributed in the nation--let alone equivalent institutes of other industrialized countries--it is evident that the funds are extremely low, concluded Pocchiari.

In 1985 IRI spent over 1100 billion lire for scientific research, declared Dr Ponsellini during his testimony; this is the equivalent of 23 percent of the total spent in research by all companies in Italy, and 12 percent of the national expenditures in research and development. The research expenditure is 3.2 percent of the total gross receipts of IRI, an amount which may not appear too high--said ponsellini--but this has to be compared to the high receipts of service companies (telephones, transportation, etc...) for which research and development is nothing or almost reduced to nothing. Concerning research personnel, there are 11,750 full time workers, of which 5,828 are researchers; this is a very high number for a company, he points out.

The vice president of ENI, Giancarlo Grignaschi, explained to the committee members the commitment of the corporation to research and development. Grignaschi pointed out how this commitment has been rather consistent; in 1985 the ENI group has invested over 320 billion lire. This year--continued Grignaschi--an even higher amount is foreseen, with an increase of about 15 percent.

Confronted with the urgency of continuous innovation, EFIM--stated Tribuno--spends every year 260 billion [lire] in research and development, or about 5 percent of total receipts, and employs 2800 people in it, equivalent to over 5 percent of the total work force. Among the long term programs, Tribuno mentioned the development of the convertiplane, an aircraft which combines the maneuverability of the helicopter and the high speed of the airplane.

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CSO: 3698/312

S&T COMMITTEE ISSUES POLICY RECOMMENDATION TO CRAXI

Rome IL TEMPO in Italian 27 Dec 86 Supplement

[Text] In a country resigned to long delays and committees hampering decision making, the simple fact that one of these committees has quickly completed its job is already a happening. It is an important event because the product is not a document of general nature, rather a specific one summarizing the problems of information technology; specifically, what actions should Italy take to fully exploit the last years of this century. We are referring to the report on science and technology to the president of the council which the magazine MEDIA DUEMILA has begun publishing in its entirety starting in November. The document was drafted after a careful analysis accomplished in 18 months of work by 12 internationally known scientists headed by Professor Luigi Dadda. Presented are proposals, recommendations,and solutions affecting the following sectors: school and culture, university, scientific research, type of scientific research, needed financial resources, relations with industry and necessary incentives, and internationalization of research as a requisite for its vitality.

The report consists of about 500 pages full of numbers and analyses from which emerges--as read in the preface by MEDIA DUEMILA--the profile of a much neglected sector. Research and development continues to be one of the less supported sectors. This is shown by the fact that total investments in this sector continue to be about 1.26 percent of the gross national product, almost half of what is spent in Germany, France, or England. We think we are doing a welcome service to our readers by publishing a synthesis of the proposals and recommendations.

The committee for science and technology was established by presidential decree on 31 October 1986. The principal duty of the committee was to draft the report which we present here in synthesis. The committee members are:

Prof Luigi Dadda- professor of electronics at the Polytechnic of Milan.
Dr Bruno Colle- director of IRER.
Prof Renato Dulbecco- Salk Institute, California.
Dr Bruno Lamborghini- director of Olivetti center for industry studies and strategies.
Prof Claudio Nicolini- professor of biophysics of the University of Genoa.
Dr Italo Rocca- general secretary of the Ministry for Scientific Research.
Eng Carlo Eugenio Rossi- president and managing director of the Fiat research center.
Prof Claudio Roveda- professor of economics and industrial management at the Polytechnic of Milan.

Prof Renato Scrimaglio- professor of physics at the University of Aquila.
Prof Emilio Segrè- Berkeley University, California.
Prof Renato Ugo- Member of board of directors of Montedison.

Introduction

The proposals presented here have been defined with the intention of promoting a quality jump in the research and technological innovation capabilities of our country, to bring her up to par with other major industrialized countries, and prepare her for the long-term challenges of scientific and technological advancements.

These proposals will be effective only if the analysis and planning phase is quickly concluded, and the implementation phase started as soon as possible. Even the most effective measures lose their value if applied too late, and we must prevent this. The country risks to lose its place among the most developed ones. The government and parliament have the responsibility to act quickly so as not to further aggravate the deficiencies in Italian research. Remedies exist, as generally agreed; these cannot be delayed, and have to be implemented immediately.

Synthesis of proposals

We identify three objectives which have absolute priority:

1. Strengthen quantitatively and qualitatively human resources essential for research by hiring at least 50 thousand youths (full time) in research during the next 5 years;

2. Increase research expenditures to about 3 percent of the gross national product within 5 years so as to quickly regain lost ground, and concentrate resources mainly in a few avant-garde sectors and 'islands of excellence'.

3. Increase research involvement on the part of industry and private groups by increasing incentives and introducing automatic financial subsidies.

The essential conditions needed to make these subsidies effective and lasting are:

A. A 'government for research' having a structure which would guarantee effective coordination and control of the nation's research activities, associating allocation of resources with the results achieved.

B. Strengthen the university by establishing a series of national standards to increase the quality of teaching and research, and by guaranteeing greater autonomy to the universities for more efficient management.

C. Strengthen the role of research bureaus (particularly that of CNR [National Center for Research] and ENEA [Nuclear and Alternative Energy]) as producers of scientific and technical knowledge.

D. Operate in the perspective of an increased internationalization of Italian research; on the one hand, creating the premise for strengthening national

research which would allow, within the EC, synergism in the utilization of resources and a just return from the investments in terms of technology; and on the other hand, interacting with developing countries as natural depository for the transfer of know-how.

Recommendations of the committee for science and technology

According to the mandate conferred upon the committee at the 7 May 1984 meeting which established the committee, and the subsequent decree of the President of the Council, the following sections will develop a series of arguments which illustrate: the present science and technology capabilities of Italian society; the relationships between the available scientific resources and the development model of the national economic system; and the future production and occupational situation of Italian society that could result from a different scientific and technological commitment.

In this introductory part the committee has synthesized a series of 'recommendations' on various guiding themes that influence development of scientific knowledge and technological know-how of a nation: from education to labor policy, from industrial policy to international cooperation and the institutions which govern research.

The committee does not intend, with these recommendations, to substitute the organs who already have these functions, i.e., the government and parliament; the objective is to stimulate and guide the current debate on these topics by means of an analysis which evaluates the 'science and technology' factor in the future development of the 'system Italy', and points out potentials and 'centers of excellence' already present in the science and technology of the country.

Within this logic a few preliminary considerations emerge:

A. The first concerns the cultural climate and the 'external economies' which influence the development of scientific potentials and the achievement of specific technological goals.

Technological innovation is a complex process requiring an active participation of the entire social system: from the school to the family, from public service institutions to industry, to those that manage research and the country's economy.

In particular, we have to spread the conviction that without a scientific mentality founded on broad-basis, well-distributed, and efficient research, it would be difficult to produce the conditions for endogenous development of innovations and the modernization of the country.

However, the development of scientific knowledge and the spreading of new technology in society and in production processes are conditioned by external factors dealing with the overall efficiency of the country; particularly by the availability and operational efficiency of transportation systems, telecommunication and data teleprocessing networks, etc... It is obvious that mobility of manpower, ideas, and information represents a necessary condition for the spreading of scientific knowledge and technical know-how.

B. The second preliminary consideration concerns the urgency with which certain provisions are to be adopted in order to improve our country's position in international science and technology.

The arguments and data presented in the second and third part of this report clearly show that investment in research and development in Italy is inferior to that of other industrialized countries. The deficiency, nevertheless, does not appear insurmountable; there are areas and sectors of excellence in which our research is at the avant-garde and our technology is competitive.

Additionally, during the last three years we are experiencing an added effort to keep up with the rest of Europe. In this perspective of the country's possible increase in scientific and technological commitment, we need to accelerate action on a number of provisions which have been under discussion for some time (like the reform of middle and high school and the reform of CNR), and assure the correct application and improvement of important laws, like law numbers 382 (university reform), and 46 (funds for applied research and technological innovations).

C. A third preliminary consideration concerns the total definition of resources, human and financial, that the country dedicates to research and development. The Italian scientific establishment suffers from insufficient funds: a total of 9,245 billion [lire] in 1985 from public and private institutions, equal to 1.3 percent of the gross national product, compared to 2.8 percent in Germany and 2.4 percent in the United States.

The modest increase in the country's research allotments (+3.7 percent in real terms in 1985 relative to 1984) does not permit, for now, achieving the government established goal, by the early 1990s, of a ratio between research expenses and gross national product in line with that of competitor countries.

Also, the total human resources dedicated to research activity--both in public and private sectors--are woefully inadequate with the requirements of an advanced country. It suffices to point out that the total number of researchers in Italy (just over 50 thousand) represents one-tenth of those in the US, one-seventh of Japan, and one-half of Germany.

The lack of researchers is more evident in applied and developmental research than in fundamental research. The ambitious objective of quickly and substantially increasing the numbers of researchers goes hand-in-hand and is of the same importance as the amelioration of the scientific and technological character of the cultural climate and means of production of our country.

On the basis of these preliminary considerations the committee has identified actions to improve the scientific and technological potentials of the country in the challenge of modernization; these are in the following areas:

- secondary and professional schools;
- university;
- research personnel;
- financial resources;
- incentives for renovation of industries;
- participation in international research projects;
- a governing system for scientific and technological activities.

These are the themes developed by the 'recommendations'--listed below--that the committee, in the limits of its mandate, presents to the President of the Council.

School and culture

The development of science and technology in a country depends, above all, on the general cultural climate. Since the cultural basis is constructed mainly through the school system, all didactic programs should include ample and detailed coverage of scientific and technological topics.

The following is recommended for the primary and secondary levels of the school system:

• a more adequate and up-to-date treatment of technical and scientific themes, augmented by new tools of learning, and specifically, the experimental tools (computer centers, laboratories, etc...)--even starting in elementary schools;

• an increase in the mandatory school age conforming to that foreseen for other European countries, so as to increase and spread throughout the country the total complement of knowledge;

•restoration and strengthening of secondary professional schools, and involvement in their financing of those sectors and organizations destined to absorb the students at the end of their studies.

For the 'tertiary' level of the school system:

• the development of an education sector, either private of public, oriented toward professional formation and qualification, and up-dating of professional skills. The regions should be given encouragement and orientation on developing this sector, since they are responsible, within the realm of the public school system, for this sector of education;

• the introduction in the universities of three levels of qualification (diploma, baccalaureate, and doctorate) already present in most western countries, and raising the quality standards by means of public control on the formative process;

• simplification of existing university rules by reducing duplication and redundancies in the decision making processes, and by eliminating procedural obstacles to university management and its relations with outside groups (in particular industry). To achieve this, the regulations on university organization provided by law number 382 should quickly go into effect, concluding the experimental phase of the law and implementing its innovative aspects (autonomy and interdisciplinary functions of departments);

• giving back to the individual university greater autonomy in decision making concerning the definition and management of teaching and research programs; in expenditures of funds and fund-raising activities; in the selection of professors; in the planning of student entrance quotas relative to the existing didactic capabilities and resources, and the desired quality of the study process;

• the strengthening of the university's role as principal seat of fundamental research through the allocation of adequate financial and human resources; especially to those scientific areas deemed necessary for the long-term development of the country;

• the issuing of rules that would assure and increase the quality of university teaching and research. Particular attention will have to be given to:

--the readjustment of didactic structures in an environment of increasing school needs, and in the presence of increased requests for upper level learning;

--the mechanisms for hiring university professors, with rules and and credentials tied to research and teaching achievements. Useful parameters of comparison are publications accepted by scientific journals of international level and patents acquired;

--career development of professors, in terms of status and retribution, facilitated by the introduction of appropriate incentives. So as to also promote and stimulate substantial 'full time' dedication on the part of professors, they should be permitted adequate free time to be utilized in full freedom, without other obligations, for contacts with the outside world of research.

The researchers

The human factor represents and will increasingly represent the strategic factor in the research and innovation capabilities of a country. It is stated that in Italy human resources dedicated to research are qualitatively and quantitatively insufficient, especially at the outset of a program of greater commitment to research and innovation about to be undertaken by the country. It is, therefore, necessary to increase the total number of public and private sector researchers in Italy to the level of other industrialized countries. The doubling, in 5 years, of the number of researchers in the country's scientific and technical sector is considered by the committee a realistic and reasonable goal. Nevertheless, attention is called upon the necessary time required for the training of the researchers--of which we have to guarantee professional quality--and therefore on the urgency of implementing the following recommendations:

• facilitate, for the researchers, the use of private limited time contracts, and work contracts in industry, university, and public research institutes;

• do not limit the number of research doctorates that can be conferred by university departments, and make available the needed funds;

• give assistance to companies which, through specific programs approved by appropriate bureaus, conduct courses for their own researchers in Italy and abroad;

• replenish public institutes of research (particularly the universities) with an adequate number of technical and auxiliary personnel to correct the present disproportion between technical and research personnel;

• draw up regulations on the legal status of researchers working in public establishments, on conditions for hiring, on salaries and career development, so as to prevent inbalances with the private sector and favor greater mobility between different research sites and bureaus;

• demand a more severe formative process for researchers (places, subjects of study, procedures), and the identification of a professsionally qualified tutor who would follow the entire formative process; and facilitate career advancement based on the quality of work and results obtained.

Financial resources

Parallel with the increase in the number of researchers, the financial resources destined to research and development--from the private sector and government--will have to be increased up to levels comparable with competing countries.

In fact, it is pointed out that research and development investments relative to added value of industry is 0.7 percent in Italy, while it is over 2 percent in Germany, United States, or Great Britain.

Because of the size of public expenditures in our country (almost 60 percent of the gross national product) and the character of the production mix of our industry, an increase in research and development funding should be considered as a means of public involvement in research and a vehicle for greater competitiveness of our products on international markets.

There is also the problem of defining the direction and scope of research expenditures. In public research there is a prevalence of academic or broad scope objectives, and resources are scattered among a wide spectrum of sectors and subjects. Few resources, instead, are committed to the solution of concrete problems and for identifying scientific solutions in answer to the country's needs. In the private sector, on the other hand, research expenditures are concentrated in very few fields (chemical-pharmaceutical, electronics, computers, transportation, and space comprise more than 70 percent of the expenditures); this is in contrast with the pervasive, multi-sector, and horizontal nature of the present state of technological evolution.

Because of this situation the following recommendations are made:

• clearly state in government programs that the objective is to increase, within 5 years, public and private research expenditures from 1.5 to 3 percent of the gross national product;

• allot at least 30 percent of public research funds to basic research done in the universities;

• guide public research funds toward a limited number of technological objectives, committing resources in a few priority projects also worked in cooperation with other European countries;

• favor acceleration of research and development investments in industry through automatic incentives, and through the creation of mechanisms or organizations

dedicated to technology transfer to the traditional sectors and the small and medium industries.

Regarding the channeling of public and private resources toward priority objectives for the country's development, the strategic importance of the following sectors is underscored:

--biotechnology (genetic and biomolecular engineering) and basic chemistry;

--third generation robotics, CAD/CAM, factory automation;

--artificial intelligence;

--new materials (superconductors, ceramics, etc...)

--broad band telecommunications;

--optics and laser;

--new generation transportation systems;

--satellites and space vehicles;

--biomedical instrumentation;

--teaching technologies.

Incentives to research and new technology in industry

In the major industrialized countries there is increasing public commitment in support of research and innovation in industry; this support is expressed through a wide variety of means and a steady availability of financial resources. Thus, innovation policy represents an important element of the government's industrial policy.

In our country, the accumulated delays in formulating and executing policy in support of research and innovation have caused a progressive deterioration in the ability of industry to compete. There is, therefore, a need to update and strengthen the public apparatus capable to intervene, in terms of availability of financial resources and efficiency and timeliness of management procedures.

A weakness in the execution of such a plan is in the procurement of public research contracts which, in all industrialized countries, constitute an efficient method of promoting research in advanced technologies and spreading the acquired know-how throughout the production system.

It is also pointed out how development of new technologies is related not only to research capabilities but also to the creation of new companies, since it activates the business and managerial potentials of the technical-scientific world (especially if adequate finances are available to sustain the associated risks). Essential is the availability of venture capital, which has seen little use in Italy so far, mainly because of the many obstacles to its development.

Regarding general objectives of industrial policy for technological improvement, the committee recommends:

• Strengthening and improving the management of the fund for applied research and the fund for technological innovation which represent, in principle, efficient means of support to medium and large size industries. The share of research and development in industry financed by the government (8.8 percent) is, in fact, less than two-thirds that of other European countries and the USA (40 precent). Such funds are to be replenished on a multiyear basis. In line with the objective of raising total research expenditures to 3 percent of the gross national product in the next 5 years, there is a need to double--as early as next year--budget allocations toward the research fund and the technological innovation fund. In addition, the procedural application of law number 46 governing the use of the funds should be simplified; this can be done by eliminating contractual encumbrances and quotas which prevent the speedy utilization of the funds;

• The introduction of incentives and tax breaks in favor of research activity in private companies, analogous to those foreseen in other industrialized countries. It is also important to introduce means of reducing taxes on products and services by new companies operating in advanced technologies;

• Improving the means for advancing technological innovation in small companies by offering help through specialized technological services and, in a more general way, through real value services. The experience of other countries demonstrates that this type of incentive (the furnishing of 'real value' services) is particularly welcome by small companies, because it is concordant with the way they utilize innovative processes;

• To favor the birth of new innovative companies there is a need for financial and tax rules which would favor, within the country, the rapid development of adequate forms of venture capital in a banking system more prone to take risks in financing technological ventures and less tied to real property guarantees and/or by rules governing public debt;

• The rapid application of law number 46 relative to public research contracts within the scope of national research programs, and within the large programs of infrastructures planned by the various ministries (Transportation, Energy, Telecommunications, Health) which allot specific funds for research, and the specification of modalities for the assignment of contracts;

• Regarding other public service sectors (for example, agriculture, public education), it seems opportune to define rules for proposals which, by specifying requirements for new technology, would favor companies presenting the highest levels of research and innovation;

• A greater selectivity in assigning resources for research and innovation, with priority toward activities of high technological and market risks.

There is also the requirement of a closer correlation between allocation of funds and verification of results.

Favored, finally, will be those technologies in which--in the medium and long term--the country wants to develop a significant presence and assume leadership positions even in the context of international collaboration.

Research management

The current development in research and the need for planning and guidance point to an urgent need for setting up an adequate control board as central place for planning, coordination, and control for the public national system of research and the incentives favoring research in private industry.

To achieve this, there is a need to define an institutional entity able to absolve such mission, and endowed with power, means, and adequate resources.

The committee deems outside its responsibility the definition of such institutional entity; nevertheless, wants to contribute in defining the more important functions necessary for efficient government action concerning research.

Necessity for coordination and planning arises from the fact that today research activity is necessarily present in varying degrees, in all sectors of production of goods and services, and within the control of various ministries. Therefore, it is proposed that appropriate controls be present in their budgets.

There is, therefore, the need for an organization that coordinates research conducted in public research bureaus associated with the various ministries; this is necessary to prevent duplication and waste, and to foster cooperation among various research programs. Such coordination can be assured either by a ministry of scientific research and technology with appropriate means of operation (that is, with executive powers), or by a temporary and subordinate entity directly connected to the Presidency of the Council (a Department for Science and Technology).

It will be the job of the ministry (or department) to formulate an annual research plan expressing the political choices necessary for the development of the country, and to verify that total research allocations of the various ministries satisfy their research objectives and, specifically, suffice for the operations of the associated research institutions such as the CNR [National Center for Research], ENEA [Nuclear and Alternative Energy], INFN [National Institute for Nuclear Physics], ISS, etc...

The plan will have to be formulated with a multiyear viewpoint in terms of research objectives and in terms of funding.

To furnish evaluation criteria necessary for the proper choices in the plan's operations, there should be provisions--through an appropriate board of overseers--for verifying the complement of research activities in the country, and for evaluating the results obtained on the basis of internationally recognized criteria (patents, publications, bibliographic citations and international references, returns on the technology, etc...)

For the function of research planning and evaluation of results the entity (a ministry or Department of the Presidency) will make use of experts in the

various fields of science and technology which could also be chosen from the international scientific community.

Regarding the conduct of public research, some modifications are appropriate in the management and structure of the principal bureaus dedicated to it. In particular for the CNR, the committee retains that the first step to take toward an improvement of the functions and efficacy of the center is to better define its planning and bequeathing functions (through its consulting committees), and also its functions of acquisition of knowledge and technology.

The following is, therefore, proposed:

• a reform of the consulting committees with respect to the rules for membership to them (half of the members elected, and half government appointed on the basis of recognized scientific achievements); and regarding their makeup, to assure an adequate representation of public and private research and users of research results.

The committees will have the duty to promote the fulfillment of the annual research plan by means of executive plans to be translated into contracts, agreements, end-product projects, etc... awarded to public research institutions or to companies, or to other private institutions.

Favored should be those programs which allow significant cooperation among various operators (companies, professors, university departments, research institutions) and guided by authoritative scientific leadership endowed with management capabilities.

Committees structured to fit the problems rather than the disciplines will permit promotion of interdisciplinary research amongst the various research institutions, assure the transfer of results to the users, and facilitate participation to international programs.

The committees will also be able to select, plan, and promote scientific services of general interest which often require large and expensive equipment (information networks, supercomputers, automated library search systems, etc...)

The members of the committees are to be compensated for their services.

To facilitate reorganization of research activity, the present research components of CNR should, after critically evaluating their scientific and technological capabilities, restructure themselves in departments independent from the committees, and eliminate superfluous structures and insufficiently manned units.

The research departments of CNR should have flexible structure so as to allow acquisition of competent personnel and the pursue of strategic scientific themes to be defined in due course.

The reorganization of the research structures of CNR should take into consideration the new technologies which are to be assigned to existing areas of research on the basis of information provided by the central organ of coordination. The management structure will, instead, administer the necessary support

for the departments; additionally, it will coordinate the research programs which will have been independently formulated by the departments in response to research plans of the committes, or in response to the broader research requirements of the country.

The new CNR should have the statute of a private organization with its own budget and funds for specific programs approved by the government entity concerned with research management.

Regarding ENEA, the committee deems that its responsibilities and areas of action should be more clearly defined versus other research institutions areas of interest.

Presently, ENEA's responsibilities are:
-energy research;
-industrial development in areas connected with energy;
-monitor site selection and security of nuclear power plants.

The presence of this institution in the generic sector of 'industrial development' and technology transfer should be in harmony and coordinated with an overall national plan, so as to prevent waste of resources and duplication of roles and activities of other institutions, especially regional or local ones.

It is therefore necessary to consolidate ENEA's activities as producer of technology and know-how in the sectors connected with the utilization and exploitation of energy resources.

Similarly, all the other public institution of research (for example INFN, Higher Institute of Health, Institute for Agriculture, hospital institutions of scientific nature, etc...) should become specialized in their respective functions, and undergo more stringent procedures to verify and control their scientific work, through a central organ of coordination.

International scientific collaboration

Interdependency of the Italian economy with the international community has greatly increased in recent years, therefore, it would be erroneous to formulate industrial and technological policies solely on a national scale.

The international technology picture clearly shows that within the leaders (USA, Japan, Europe) very ambitious research projects are beginning to take shape, the goals of which are to restructure the technological foundations of the production and social systems--considered necessary for achieving their objectives of development.

The structural character of the present technological transition, the complexity of the problem, and the magnitude of human and financial resources required, show the inadequacy of a purely national approach for many technological fields, which should be at least at the level of other European countries. Our country's non-participation to research projects requiring international cooperation at the European and extra-European level, could mark our definite exit--and most

difficult to recoup--from the group of most advanced scientific and technological countries.

Among the available options for international scientific and technological cooperation, we should favor the European scene, in accordance to the ongoing process of political and economic integration of the old continent.

Already in development or planning stage are European projects (ESPRIT, BRITE, RACE, etc...) which open channels of collaboration between industrial groups and/or research centers of various countries.

It is recommended, therefore, to define and put into action concerted programs to support active participation of national research (in all its components) to such projects and to offer our collaboration.

In particular it seems opportune:

• to allot new funds for European research projects so that our industrial-technological complex is not penalized relative to that of other European countries;

• insure that Italian participation is integrated with national projects already in progress;

• carefully evaluate and allot adequate resources for a positive return from such participation, useful for industrial production and for broadening our technological and scientific system.

Internationalization of research cannot preclude extensive interaction with developing countries. Help to developing countries cannot stem solely from emotive reasons, even if these are understandable; it has to be given by means of a transfer of scientific and technological know-how, through appropriate ways and in the appropriate quantity. Italy, who already has contributed significantly to developing countries, should continue in this direction;

• by organizing training projects in Italy for researchers from developing countries, and training projects in developing countries for young Italians who want to work there;

• by setting up research organizations in developing countries with which Italy would cooperate, and by strengthening research institutions in Italy concerned with the scientific and technological problems of developing countries.

These initiatives should permit the development of an intense cultural, scientific, and economic activity in developing countries, with significant returns even for our country.

13120
CSO: 3698/312

TOTAL R&D EXPENDITURES IN ITALY OUTLINED

Rome NOTIZIE AIRI in Italian Jul-Oct 86 p 39-41

[Text] It is forecast that this year in Italy about 10,211 billion lire will be spent in all forms of research (pure, applied, and developmental), with an increase of 39.4 percent over 1984, the last year for which final data are available. During this year 2,888 billion lire more will be spent, 1,291 through public administration and 1,597 by public and private companies.

This is what comes out from the data furnished last June by the Central Statistics Institute which, on the basis of information received from the interest groups, has developed estimated data for 1985 and 1986 on scientific research conducted in Italy, and has published final data for 1984.

For 1985, the estimated expenditures total 9,343 billion lire, with an increase of 2,020 billion over 1984, 1,027 of which were spent through public administration, and 993 by industry. It is interesting to note that an analysis of the estimated expenditures by economic sector shows a substantial increase in capital account expenditures in 1985 and 1986, equivalent to 40.3 and 43.5 percent respectively. For these two years, the groups involved in research estimate a greater increase in research expenditures through public administration (+30.2 percent in 1985 relative to 1984), and by industry in 1986 (+41.3 precent relative to 1984).

It is estimated that in 1986 pure research will experience the greatest increase in expenditures (+52 percent over 1984, for a total of 1,770 billion). Applied research will see an increase of 45.7 percent (4,080 billion in total expenditures), and developmental research will experience an increase of 29.9 percent (4,361 billion total spent in 1986).

For 1984, the year for which ISTAT [Central Institute of Statistics] gives complete and final data, the total research expenditure was 7,323 billion lire, with an increase of 1,296 billion over 1983, or 21.5 percent. Distribution of expenditures by type of research shows that the greatest expenditure was made for for development, to which 3,357 billion lire were channeled, equivalent to 45.9 percent of the total; applied research follows with 2,801 billion (38.2 percent), and pure research with 1,165 billion (15.9 percent).

1 **Spese per settore, tipo di ricerca, destinazione economica e fonti di finanziamento - Consuntivo 1984 - Previsione 1985-1988** (milioni di lire)

2 VOCI	3 Amministraz. pubblica			4 Imprese			5 Totale			6 Variazioni %	
	1984	1985	1986	1984	1985	1986	1984	1985	1986	1985/84	1986/84
7 TIPO DI RICERCA											
8 Ricerca pura	1 115 730	1 525 307	1.701 202	48.804	61.647	68 989	1 164 534	1 586 954	1 770.191	+ 36,3	+ 52,0
9 Ricerca applicata	1 189 259	1 602 785	1 714 683	1 611 921	2 118 791	2 365 337	2 801 180	3 721 576	4 080 020	+ 32,9	+ 45,7
10 Ricerca di sviluppo	889.709	1 093 757	1 070 617	2 467 528	2 941 087	3 290 272	3 357 237	4 034 844	4.360.889	+ 20,2	+ 29,9
11 DESTINAZIONE ECONOMICA											
12 Spese correnti	2 283.497	3 025 555	3 326 406	3 719 226	4 465 566	4 990 350	6 002 723	7 491 121	8 316 756	+ 24,8	+ 38,5
13 Spese in conto capitale	911 201	1 196 294	1 160 096	409 027	655 959	734.248	1 320 228	1 852 253	1.894.344	+ 40,3	+ 43,5
14 FONTI DI FINANZIAMENTO											
3 Amministrazione pubblica	3 134 256	4 125 868	4 378 945	742 071	921 926	905 323	3 876 327	5 047 794	5 284 268	+ 30,2	+ 36,3
4 Imprese	51 074	83 334	92 914	3 131 432	3 865 038	4 403 694	3 182 506	3 948 372	4.496 608	+ 24,1	+ 41,3
15 Estero	9 368	12 647	14 643	254 750	334 561	415 581	264 118	347 208	430 224	+ 31,5	+ 62,9
5 TOTALE	3.194.698	4.221.849	4.486.502	4.128.253	5.121.525	5.724.598	7.322.951	9.343.374	10.211.100	+ 27,6	+ 39,4

Key:

1. Expenditures by sector, type of research, destination, and sources of finances- Final balance sheet for 1984- Estimated for 1985-86 (million lire)
2. Type
3. Public administration
4. Industries
5. Total
6. Changes
7. Type of research
8. Pure research
9. Applied research
10. Developmental research
11. Economic destination
12. Current expenses
13. Capital expenses
14. Sources of finances
15. Foreign

Relative to 1983, the greatest percent increase occurred in development (24.2), followed by applied research (19.5), and pure research (18.8). Industry contributed 4,128 billion, equivalent to 56.4 percent of total expenditures; the major share of these expenditures were borne by private industry with a total of 2,543 billion (34.7 percent of total expenditures and 61.6 percent of the total for the sector). Public sector research expenditures were 3,195 billion, or 43.6 percent of the total.

A closer analysis of the expenditures by sector and by type of research shows that for pure research, expenditures by the public sector were the highest (95.8 percent of total); for developmental research industry expenditures were the highest (73.5 percent of total).

Expenditures by economic distribution show that of the 7,322 billion total spent in 1984, 6,003 went for current expenditures (82 percent): the major portion of which was for salaries.

Finally, concerning the sources of financing, of the total 7,323 billion, 3,876 billion come from public administration, 3183 from industry, and only 264 from foreign sources.

Following is a summary table from ISTAT, showing the final balance sheet for the 1984 expenditures, and estimated expenditures for 1985-86.

13120
CSO: 3698/312

ITALY'S EFIM FINANCES R&D

Rome NOTIZIE AIRI in Italian Jul-Oct 86 pp 1-7

[A speech given by Prof C. Tribuno, president of the Breda Research Institute and leader of the 'Research and Technology' team of EFIM, at the meeting of the AIRI members held at the AIRI headquarters in Rome, on 3 July 1986]

[Text] The profound changes in consumer goods during the last three years have caused a parallel revision in industrial strategy and management of research and development.

The most significant factor causing these changes seems to be the increased complexity of consumer goods. I refer not only to the number of components parts of a product or the functions it can perform, but also to the variety of advanced technologies--almost always interdisciplinary--involved in its fabrication.

This increased complexity of industrial products requires a continued effort in basic and applied research, and in the development of production and application methods.

Another and important element of the changes mentioned previously, is the shortening of the lifecycle of products as a result of increased speed of technology innovation and production processes. In other words, product and technology generations are becoming shorter. This induces companies, who now have a shorter time to market the same quantity of products, to search for new markets worldwide. However, they are confronted with keen competition--constantly fueled by upcoming countries--which does not allow flaws in the technology and the quality of the product.

Therefore, there is an urgency for continuous action in research and development. To answer these technological challenges, EFIM [Manufacturing Industry Holding and Financial Company] has committed human, technological, and financial resources to research and development. In this activity the company invests annually over 200 billion lire, representing about 5 percent of its receipts, and employs more than 2000 workers, or more than 5 percent of its total work force.

Research is mainly conducted along planned lines of development for the company which regards the following sectors as strategically important:
- aeronautical systems
- defense systems

- land transportation vehicles
- new materials.

In the sector of aeronautical systems, research takes off from the skills which permitted the construction of advanced aircraft, such as the A109 and the A129 helicopters of Agusta, or the trainers or tactical support aircraft of SIAI Marchetti. The mid-range projects concern the construction of new aircraft like, for example, the AH101 helicopter which is being developed in collaboration with Westland and which will be developed in various versions: antisubmarine, military and civilian transport, off-shore service, and rescue service.

Such developments are in line with the increased strategic needs of defense and civil protection, and comfort requirements of commercial transport. A major portion of the development effort is dedicated to advanced avionics, with the adoption of electronic control systems of high computational capabilities and operationally fault-tolerant; these control systems allow the new aircraft to complete their job efficiently and with absolute reliance, even in very difficult missions.

Long term programs include the development of the convertiplane, an aircraft that has the in-flight maneuverability of the helicopter and the high speed of the airplane, and has the fuel consumption of the latter.

In the defense systems sector, the successes met by the Ernesto Breda financial group of companies (OTO Melara, Breda Meccanica Bresciana, Officine Galileo, SMA, etc...) on the international market, have been a stimulus to a continual product evolution. Under study, therefore, are second generation armored vehicles and a new line of missiles for various tactical uses.

Research in this field--we should emphasize--is not exclusively for development of defense vehicles; civilian applications a equally important and are sought with similar diligence. Such is the case of self-propelled robots for use for civil protection, or for electro-optical devices developed for weapon systems and which find important civilian applications.

In the land transport systems research points to the development of vehicles which, through appropriate design and the use of advanced light materials, allow high performance with low energy consumption.

Examples of this design philosophy are the metro trains for Cleveland and Washington, which have affirmed the success of the Breda Costruzioni Ferroviarie [Breda Railroad Constructions] on the difficult American market.

Nevertheless, research is not limited to transport vehicles, but includes the entire system of commercial transportation; in the field of merchandise transport, for example, an advanced system is intermodal transport which considerably reduces operation costs by drastically reducing operation times (unloading and stockage).

Examples of this type of development are the wagon for intermodal transport developed by Ferrosud of Matera under the auspices of the Progetto Finalizzato

Trasporti [Finalized Transportation Project] of the CNR [National Center for Research]; and the container transport system developed by Officine Reggiane of Reggio Emilia.

In the sector of new materials, research takes off from the technologies and skills within EFIM, and specifically SIV for glass, and Aluminia for aluminum. Development is being conducted in the fields of new materials, new alloys, compounds, and ceramics. Simultaneous to the development of new materials, research is being done at the Officine Galileo of Florence on surface finishes. For the planning of strategies and operational programs in the sector of new materials, an ad hoc task force has been created at EFIM, with the participation of outside specialists, specifically for the development and application of polymer materials.

The development of the mentioned products is associated with a vast innovative effort comprising the entire production process, from the design phase to the construction and component assembly phase; the process utilizes CAD/CAM technology and automated robot systems. In the application of these techniques, everything is integrated in an all-encompassing design for managing the production process system, which achieves better product quality than traditional systems and maximum economy in costs.

The achievements in this field are of interest to all sectors, and offer excellent returns in other activities of the company, such as plant design, process design, and mechanics--activities which are regaining interest through a reorganization of the production process.

The various production sectors which we quickly reviewed, constitute the major structure of the company; their activities overlap and enrich each other.

An example of these capabilities for synergism is the development of the Minerva project for civil protection, the purpose of which is the development of an integrated system for forecasting, prevention, and management of aid in case of natural disaster.

Along the same lines, the company has prepared itself for participation to the Eureka and SDI programs, and is getting ready a strategic plan for greater participation in the sector of industrial diagnostics.

Finally, we want to point out the innovative developments foreseen in the sector of food production and, specifically, the application of biotechnology to aquaculture.

This diversified complement of project has required the creation of appropriate organisms, within the central structure of EFIM, for the planning and management of research. Therefore, a scientific council was formed in early 1985, and eminent people in science and technology were asked to become part of it. This council has the task to coordinate, in a scientific sense, the functions of the central strategic planning groups with those of each sector, and to make suggestions and proposals for new projects. Additionally, also at the EFIM level, a central research and technology office has been created; its task is to plan and coordinate the research activities of the company.

Research activities within the company take place at various levels: at the production level, subjects of more direct company interest are mainly tackled; subjects covering broader topics or of interest to many sectors are developed at the two research institutes of the company: the Breda Institute for Research with laboratories in Milan and Bari, and the Experimental Institute for Light Metals with laboratories in Novara and Porto Vesme.

Associated with these institutes, which have been operational for many years, EFIM is beginning the formation of centers of excellence; these will operate in specific innovative areas. First among these, in chronological order, is the center for research in optronics presently being formed and to be located in the area of Florence. The center will constitute a meeting point for dialogue with other research groups, particularly those connected with CNR, and also with industrial groups present in that area.

The overview of research activities presented is the weapon EFIM has prepared for a winning participation to the competitive challenge of international markets outlined at the beginning.

Factors which determine its effectiveness are a long term strategy, an integrated management for the various production entities of the company, and a renewed policy of strengthening internal resources in technical competency, plants, and means and systems of production.

13120
CSO: 3698/312

BIOTECHNOLOGY COMMITTEE RECOMMENDS NEW R&D POLICY

Rome NOTIZIE AIRI In Italian Jul-Oct 86 p 38-39

[Text] Objectives and methods for improving Italian research in biotechnology have been identified in the first report of the national committee for biotechnology, and presented to the minister for scientific and technological research, Senator Luigi Granelli, who had instituted the committee in July 1985. The report analyzes in depth the application of advanced biotechnologies to the health industries, chemistry and energy, to the protection of the environment, to forestry, zootechny, and to the food industry. Also analyzed is the present situation in Italy and the means for support and development of biotechnologies in industrialized countries.

Biotechnologies--the report emphasizes--represent activities particularly suited to a country like Italy, because they require very little investments in funds, raw materials, and energy, and can increase the value of plant life raw material; but most importantly, their development relies essentially on the intellect, culture, and management capabilities of scientific workers and the production environment. The Italian position--according to the experts who drafted the report--is very weak in the spread of basic biotechnology research and its application to production processes. Very few centers of industrial agricultural and food production have at their disposal the most advanced technologies in the field; additionally, there is a lack of orientation toward the biotechnologies in the food production industries.

This weak network competence and production capabilities can be strengthened by an organizational and funding effort, since the potentials of our country are appreciable and the required investments are relatively small.

The major means for action proposed by the committee in the report are:

1. Strengthen the activities of public institutes and universities in the field of biotechnology, including immediate start of a program of scholarship grants for preparation of researchers;

2. The start of at least three projects of the CNR [National Center for Research] which address applications in health, chemistry, and agricultural food production;

3. Launching of a national research program under the auspices of Law 46, dedicated to productive applications of biotechnologies in various sectors, and with specific emphasis, in the short term, in biomedicine, and an expansion in the medium term to the chemical and agricultural food sectors;

4. Create incentives for productive investments, especially by providing funds for the formation of biotechnology research companies; grant tax exemptions for initiatives in the field; and encourage direct cooperation between public institutes and research companies.

The cost of these programs--according to the committee--is estimated at about 1000 billion lire, during the 1986-90 five year period.

13120
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ITALY'S FINMECCANICA PARTICIPATION IN EUREKA

Rome NOTIZIE AIRI In Italian Jul-Oct 86 p 11

[Text] Four companies of the Finmeccanica group (Ansaldo, Aeritalia, Alfa Romeo Avia, and Alfa Romeo Auto) are participating in five projects within the Eureka program; these are among the 62 new projects recently approved by the EC ministers convened in London.

Italy participates in 13 of these recently approved projects, with a total projected cost of 740 billion lire (negotiations are under way for eventual participation to nine other projects). Of the Finmeccanica companies, Ansaldo participates to two projects: the first concerns advanced third generation mobile robots for application to accident prevention, the second concerns the intelligent control system 'Europolis' to facilitate traffic in the city and outside. Aeritalia participates in the advanced project 'Apex' for the exchange of information and applications in the aerospace sector, while Alfa Romeo Avio is interested in a project on the use of ceramics in gas turbines of up to 10 megawatt power. Lastly, Alfa Romeo Auto participates in the 'Prometeus' program for a more efficient road traffic system.

13120
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FRG 1986 R&D SUBSIDIES FOR MEDIUM-SIZED FIRMS REPORTED

Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 445/446, 20 Dec 86 p 3

[Text] In the FRG there are approximately 45,000 companies in the processing industry (not including the craft trades) with fewer than 500 employees. This group of companies, termed small and medium-sized companies, employs 3.3 million people and accounts for one-third of the gross national product. Around one-third of these companies carry out their own research and development.

The innovative ability of small and medium-sized companies has long been underestimated. It is true that medium-sized companies are clearly inferior to large companies in some fields: For example, it is more difficult for them to gain access to the capital market, and they are able to obtain and process technological information as efficiently as large companies. As a rule, however, they are more market-oriented, have briefer decisionmaking procedures, and are more flexible. Therefore, they are able to adjust their production to sudden changed in demand.

In a comprehensive report on the promotion of research in small companies, Federal Research Minister Riesenhuber stressed that the support of research and development in small and medium-sized companies is an important task of research and technology policy because of the general economic and innovative importance of these companies and in view of the increasing demand on these companies for economic and technical adaptability. It is a specific task of the specialized research and technology policy to strengthen small and medium-sized companies in the utilization of their innovative potential in situations where they are unable to independently overcome serious disadvantages related to their size. The subsidy measures of the BMFT [Federal Ministry for Research and Technology] therefore have the following goals:

--strengthening of the personnel base responsible for research and development;

--prompt application of important technological innovations;

--increased research cooperation and expanded technology transfer; and

--provision of more venture capital, especially for new technology oriented companies.

The following table provides a survey of the federal government's subsidy measures for small and medium-sized companies:

Reinforcement of research and development personnel	Promotion of prompt application of new technologies	Intensification of research cooperation and of technology transfer	Promotion of the provision of venture capital
Personnel cost-subsidy and support for increases in research personnel	Indirect-specific measures	Common industrial research	Formation of technology oriented companies
	Promotion of projects related to the technical program	Promotion of commissioned research (BMFT subsidies for commissioned R&D)	Basic condidi-tions for the financing of ventures
		Promotion of research cooperation between science and industry (subsidies for research cooperation)	
		Technology and innovation advise; technical information systems	
Estimated subsidies 1986 in Millions DM			
500	298	149	70

In conclusion, the research minister said that it is clear that small and medium-sized companies make an important contribution to the competitiveness of the FRG. Assistance for these companies would show that small companies are the "favorite children" of national government research promotion.

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BMFT AMENDS SUBSIDY GUIDELINES FOR TECHNOLOGY-ORIENTED COMPANIES

Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 445/446, 20 Dec PP 6-9

["Amendment" to the guidelines for the pilot project °Promotion of the Establishment of Technology-Oriented Companies" issued on 8 December 1986 in Bonn by Dr Grunau on behalf of the Federal Minister for Research and Technology]

[Text] Contents:

1 Purpose of Grant, Legal Basis

1.1 The aim of the measure is to stimulate, to a greater extent than in the past, the establishment of new companies in those technological fields which have potential for the future, and to support newly established companies. This should also lead to the provision of more private capital for the establishment of these types of companies, as a result of cooperation between technology consulting centers and capital suppliers.

The measure will be tested through a pilot project over a given period of time. For the establishment of companies or for the support of newly established companies, the government grants consultation aid and project subsidies in accordance with the following guidelines and with the previous administrative regulations per paragraphs 44 and 44a of the Federal Budget regulations, and according to the project stage of the innovation project and the Government also participates in joint ventures to that end.

1.2 Applicants are not automatically entitled to grants. Rather the decision is made by an authorizing committee and is based on dutiful consideration, taking into account the availability of funds.

2 Subject of Promotion; Type, Range, and Amount of Grants

2.1 The government grants project-related subsidies and participates in joint ventures for innovation projects which are connected with the establishment of technology-oriented companies or which aim to create or strengthen the technological base of newly established small companies.

2.2 Unless a plan for an innovation program already exists and is ready for assessment, non-reimbursable subsidies for the preparation of documents for assessment can be granted for up to 90 percent of subsidizable outlays, in accordance with No 2.8; however, the grants must not exceed DM54,000. In justifiable individual cases, involving very expensive work by a third party--see No 2.8.4--the grant ceiling may be raised to DM108,000. The duration of the subsidy should not normally exceed 9 months (Phase I).

See 4.3.5 for information on support from venture capital societies for Phase I project.

2.3 For the financing of innovation projects (research and development work), grants in the form of non-reimbursable subsidies can be provided for up to 75 percent of subsidizable outlays in accordance with No 2.8; however, in principle, these must not exceed DM900,000.

Bank credits necessary to finance these projects may be secured for up to 50 percent; however, this may not exceed DM150,000 through individual joint ventures. (Phase II).

2.4 Bank credits required for financing outlays for the establishment of production and introduction into the market can be secured up to 80 percent; however, this may not exceed DM1.6 million through individual joint ventures (Phase III). For these credits the bank will allow at least 2 redemption-free years.

2.5 Joint ventures in accordance with 2.3 and 2.4 have a duration of up to 10 years.

A joint venture will not be undertaken for credits that already have been granted.

2.6 Joint ventures will only be considered in the case of credits for which long term security cannot be provided. Available securities, in particular those objects which are to be financed with the credit, are to be quoted as credit securities. The liability of the borrower for the credit received will not be affected by the government's joint venture.

2.7 The joint venture covers the bank's claims up to the stipulated amount, according to evaluation in the case of a deficit, including interest and prosecution costs. Until a case of damages arises, the obligations are the same as those for the credit share not covered by the joint venture.

2.8 The following outlays for innovation projects can be considered:

2.8.1 Personnel outlays determined as the total of project-related annual gross wages and salaries subject to income tax without wage and salary elements which are dependent on sales and earnings.

For companies and people who hold capital shares in the company, and who are cooperating in the project, personnel outlays on the basis of comparable salaries can be claimed for up to DM50,000 per year in each case and can be paid. Personnel outlays to family members who have collaborated cannot, in principle, be considered.

2.8.2 Materials outlays (including project-related use of materials already in the possession of the grant recipient).

2.8.3 Outlays for renting space and machinery, repair costs, acquisition costs, patent filing costs, computer costs, licensing fees. Acquisition outlays include all outlays necessary to notify experts about the project. This includes, in particular, costs for fair stands as well as costs of printing appropriate quantities of informational material.

2.8.4 Outlays for project-related consultation from third parties and for third-party contracts (for tests, expert opinions, expertise, market studies, research of literature, databases and patents and the production of prototypes.

2.8.5 Investment outlays (for plant and business equipment, for development and production facilities).

2.8.6 In order to cover remaining outlays a lump sum of 40 percent can be considered for the outlays in accordance with 2.8.2.

2.9 Within the framework of Phase I only outlays in accordance with numbers 2.8.2 and 2.8.4, and outlays for business trips and computers may be considered.

2.10 Within the framework of Phase II, acquisition outlays for up to a maximum amount of 15 percent of the subsidizable outlays and outlays equipment which can be used for production as well as for development can only be considered in exceptional cases. Acquisition outlays include all outlays necessary to notify experts about the project. This includes, in particular, costs for fair stands as well as costs of printing appropriate quantities of informational material.

3 Grant Recipients

The following may apply:

3.1 People who intend to establish a technology-oriented industrial company, or

3.2 Technology-oriented companies in trade and industry which:

3.2.1 Have been operating for no longer than 3 years,

3.2.2 Have no more than 10 employees, and

3.2.3 In which the majority shares are not held by third parties (natural persons and corporate bodies). Shares of 50 percent or less, and other shares held by third parties are not detrimental if the business aim of the third party differs considerably from that of the applicant.

However, profit and loss underwriting contracts and other contractual and legal agreements which may affect the autonomy of the applicant are prejudicial. This can also include common sales interests and receipt and delivery commitments.

3.2.4 Exceptions to the limits of Nos 3.2.1 and 3.2.2 are possible. This applies, in particular, to service companies (e.g., engineering bureaus, trade companies) which are not engaged in production themselves or through holding companies, and who wish to enter the production sector through the planned innovation projects.

3.2.5 One or more of the shareholders of the company submitting an application must possess technical knowledge necessary for carrying out the project.

These people must possess at least 25 percent of the shares and, in Phase II and III projects, must dedicate most of their working hours to the basic projects.

3.3 Venture capital societies (see number 4.3.5) which contract with third parties for project-related consultation.

4. Prerequisites for the Grant

4.1 Support is available for the following innovation projects:

4.1.1 Projects whose aim is the development to the marketable stage and subsequent marketing of new products, processes and technical services, which, due to their technical innovation, are expected to be competitive and to have good market prospects.

4.1.2 Projects, whose implementation requires developmental outlays which involve significant technical risk.

4.1.3 Projects which seem technically and economically viable and which show signs of long term success for the company.

4.1.4 Projects for whose development and commercial conversion the applicant does not possess sufficient financial means.

4.1.5 Projects which, in the case of product developments, propose industrial self-production (at least of the most important components); in the case of process developments, self-production of crucial devices, equipment, components, or materials, and in the case of technical support services, the creation of new, technically demanding process technologies as well as marketing these support services.

4.2 The innovation projects should, as a rule, be carried out in those regions which are supervised by the following centers:

--the Ruhr Technology Advice Center, based in Bochum with the districts of the chambers of commerce/industry [IHK's] of Bochum, Dortmund, Duisburg, Essen, Hagen and Muenster.

--East Bavarian Technology Transfer Institute, based in Regensberg with the IHK districts of Bayreuth, Coburg, Regensberg, and Passau.

--VDI-Technology Center of Berlin with the federal state of Berlin.

==the Hamburg Institute for the Promotion of Technology with the federal state of Hamburg and the bordering federal states of Lower Saxony and Schleswig-Holstein.

--the Center for Production and Technology (registered association) of Saarbrucken, with Saarland, and

--IHK Company and Technology Consultation, Karlsruhe GmbH based in Karlsruhe, with the IHK districts of Karlsruhe and Pforzheim.

4.3 For those not included in the regional limits in number 4.2:

4.3.1 Innovation projects in which microelectronics is crucial and in which independent development work in the microelectronics field predominates, as well as projects which aim to produce equipment for the production of microelectronic components.

In principle, these projects will be supervised by the VDI Technology Center, Berlin. If they fall into the districts of the regional centers according to No 4.2, supervision will be established on agreement among the shareholders.

4.3.2 Innovation projects from the following biotechnology sectors:

4.3.2.1 Cell culture engineering

4.3.2.2 Genetic engineering

4.3.2.3 Biotechnical processes with plant, animal, and human cells and microorganisms altered through genetic engineering.

4.3.2.4 Enzyme processes for drug and food applications.

4.3.2.5 The development of devices and equipment for 4.3.2.1 and 4.3.2.2

4.3.2.6 Bioreactor developments including control engineering and test methods for the processes in 4.3.2.3 and 4.3.2.4.

4.3.3 Innovation projects which will be carried out in up to 15 selected promotion centers or technology parks.

These promotion centers or technology parks will be designated by the federal states in agreement with the BMFT.

The projects will be recommended for support to the BMFT by the management of these centers, and in the event of support will also be supervised by the centers.

4.3.4 Innovation projects in Phases II and III for which venture capital societies hold at least 25 percent of financing means.

In these guidelines, the term venture capital societies applies to companies whose business objective is to provide newly established and already existing medium-sized companies with shareholder's equity or similar types of equity as well as with management support for a limited period of time.

They can be identified by their company contract and their current business activities.

In addition, venture capital societies must prove that they have at least DM3 million available for the aforementioned purposes: Existing invested capital will be taken into account.

4.3.5 Venture capital societies can receive grants as non-reimbursable subsidies for expert opinions on investment applications as follows:

--In the first 12 months following the entry into force of the guidelines, up to 80 percent, but not to exceed DM48,000;

--In the following 12 months, up to 60 percent, but not to exceed DM36,000;

--Thereafter, up to 40 percent, but not to exceed DM24,000; of the individual remuneration (excluding sales tax) paid on third-party contracts (requests for consultation services, expertise, market research, and research of databases, patents, and literature). The investment applications must fulfill all formal and written requirements of the pilot projects. This will be verified by the venture capital societies within the framework of a preliminary examination which includes expenditures equal to at least 3 working days or DM3,000 and is to be recorded in the form of a short report which is to be submitted with the grant application.

4.3.5.1 In justifiable individual cases, the ceilings mentioned in 4.3.5 may be doubled for particularly extensive market and feasibility studies; the subsidy rates remain unchanged.

4.3.5.2 The following third-party contracts are not eligible for subsidy:

--Those in which the contract was in place before submission of the application for subsidies; the date of receipt by the BMFT is the determining factor.

--Contracts which the applicant intends to place with closely connected natural persons or corporate bodies (contractor). This is the case:

--if the contractor is in direct or indirect possession of shares of the applicant, or if the applicant can exert direct or indirect controlling influence over the contractor, or vice versa, if the contractor possesses shares of the applicant or can exert controlling influence over the applicant, or

--if a third party possesses shares of both the contractor and of the applicant, or can exert controlling influence, directly or indirectly, over both of them, or

--if the contractor or the applicant is in a position, during the deliberation on terms of the business relationship, to exert influence on the applicant or the contractor from outside this business relationship, or if either of them would benefit from the income of the other.

In addition, third-party contracts will not be subsidized if they are already financed by other means.

5 Procedures

5.1 Submission of application

5.1.1 Applications for grants should be submitted to the supervision centers listed in Nos 4.3, 4.3.1 and 4.3.2, or to the promotion centers and technology parks, yet to be named.

5.1.2 Applications in accordance with 4.3.4 (Phase II) and 4.3.5 (Phase I) are to be submitted to the BMFT, ref 411, until further notice.

5.1.3 Applications for joint ventures (Phases II and III) are to be submitted by the local bank to the bank for the equalization of burdens in Bonn.

5.1.4 Applications must contain the guarantee that the information is truthful. The information about the legality of the application and the conditions for subsidies and about the purpose will be taken into account for the subsidy in accordance with paragraph 264 of the penal code in conjunction with paragraph 2 of the subsidy law.

5.1.5 As a rule, applications will be preceded by (cost-free) consultation from the responsible centers or from the appropriate promotion center or technology park.

The consultation centers, promotion centers, technology parks, and the bank for the equalization of burdens act on behalf of the BMFT; they may obtain further clarification of data and explanations from the applicant, and with consent of the applicant, may call in experts.

Employees of the consultation centers, promotion centers, and technology parks, and the bank for the equalization of burdens are obliged to maintain confidences.

5.2 Application Period

Application for promotion may be submitted immediately and up until 31 December 1988. Project-related outlays may be billed as of the date of receipt of the application at the responsible supervision center, technology park, promotion center, the bank for the equalization of burdens or, in the cases named in No 4.3.4, at the BMFT;

The application must contain documentation appropriate for evaluation.

5.3 Approval and Implementation

5.3.1 The subsidy decision is made by the BMFT, on the recommendation, if applicable, of the supervision centers, promotion centers, or technology parks, or the bank for the equalization of burdens.

5.3.2 The completion of projects is controlled by supplementary agreements, by means of which subsidy requirements, proof of its utilization, and the right to examine this proof, are regulated.

5.3.3 The consultation centers and the promotion centers or technology parks offer, in particular, consultation services for the grant application, checking of applications, and technical presentation of the project.

5.3.4 The grant approval, payment, and calculation of subsidies, as well as the proof and examination of its utilization, and, if necessary, the required cancellation of the decision regarding the subsidy and the request for reimbursement of the subsidy must all comply with the previous administrative regulations per paragraphs 44, 44a of the Federal Budget Regulations, unless exceptions are permitted in these guidelines.

6 Effective date

These guidelines will be in force as of 1 January 1987.

8701
CSO: 3698/M148

BRIEFS

EUREKA SPINOFFS IN UK--A 420 million pounds initiative to improve the exploitation by industry of the publicly funded research and development programmes was announced by the UK Prime Minister on December 10, 1986. The principal sponsors will be the Department of Trade and Industry and the Department of Education and Science. The coordinator of the project is John Fairclough, chief scientific adviser at the Cabinet Office. Through this initiative inspired by the Eureka project, called "link", the government's contribution will reach 210 million pounds over the next five years, the other 210 millions being provided by participating industries. The main objective is to foster strategic areas of academic and industrial research within which UK industries have some chance to be competitive in the world market. 27 areas have already been identified by the different departments. For further information, please contact: Link Steering group, Secretariat 125 Victoria Street, London SW1E 6RB. Tel: (01) 212 66 47. [Text] [By Robert Magnaval, scientific attache at the French Embassy, Silver City House, 62 Brompton Road, London SW3 1BW, tel. (44.1) 581.07.11] [Paris R&D EVALUATION NEWSLETTER in English 11 Feb 87 p 8]

COLOGNE TECHNOLOGY CENTER--An agreement to establish the Technology Center for Measurement and Analysis Techniques (TEMA) in Cologne was recently signed by the Cologne-based Leybold-Heraeus Company and Professor Dr Reimut Jochimsen, the Nordrhein-Westfalen minister of economy and technology. The center primarily will give impetus to middle-size industry through the introduction of technically demanding products. The state is participating with 49 percent of the new enterprise, which is set up with a nominal capital of DM200,000 and will operate on the premises of Leybold-Heraeus. The remaining 51 percent is provided by the Cologne company. Interested companies in Nordrheim-Westfalen will also be offered the possibility of taking part in this enterprise. The new Technology Center will support companies dealing with microelectronics, biotechnology and genetic engineering, materials technology, environmental technology, and measurement and control techniques in research, development, and production with the most modern measurement and analysis methods. Close cooperation with the technical schools and research institutions of Nordrheim-Westfalen will also be pursued, from which an acceleration of the conversion of scientific knowledge into marketable products is expected. The chief goal of all these efforts is to establish in the medium term a larger number of secure jobs in modern technology. [Text] [Bonn TECHNOLOGIE NACHICHTEN-MANAGEMENT INFORMATIONEN in German No 444, 28 Nov 86] 8613/12232

CSO: 3698/M123

GDR GENETIC ENGINEERING ACCOMPLISHMENTS NOTED

East Berlin BAUERN-ECHO in German 14-15 Feb 87 p 7

[Article by Dr Rolf Kraushaar of the Central Institute for Molecular Biology of the Academy of Sciences of the GDR: "Practical Results Achieved: Genetic Engineering--A Far-Reaching Productive Force of Biology"]

[Text] The term "genetic engineering" comprises a molecular biology methodology that makes it possible to isolate, characterize and clone genes as structural and functional units of the genetic make-up, to copy them in the "test tube," to subject genotypes to recombination, as well as to introduce genotype into selected receiver cells and in this way to very purposefully create living organisms with features not provided them by nature.

Made possible by fundamental discoveries in molecular biology in the last few decades, genetic engineering--one of the most important focuses of biotechnology--has, since around the beginning of the 1970s, produced revolutionary theoretical and practical results on an international scale. One example of this is the production of human hormones by bacteria, such as in insulin, which is necessary for the treatment of diabetes, or somatostatin, the growth hormone.

The following comparison reveals the significant amount of progress that has been achieved in this manner: In order to get around five milligrams of the above-mentioned animal growth hormone, its discoverer had to process 500,000 sheep brains. Using bacteria manipulated through genetic engineering, eight liters of bacteria suspension were sufficient for isolating the same quantity of the substance.

Because of these fundamental, qualitative changes in the biological productive forces, far-reaching prospects for introducing revolutionary innovations have emerged not only for the pharmaceuticals industry, the food industry and other branches of industry, but also for human and veterinary medicine, agriculture and environmental protection.

The timely definition of and orientation towards the appropriate focal points for research has guaranteed that those principles that are indispensable for the spectrum of genetic engineering methodology are being dealt with intensively in our republic as well. In the facilities of the fields of

biosciences and medicine at the Academy of Sciences of the GDR, important practical results have already been achieved on the basis of national and international cooperation. Among them is the process for producing the alpha amylase enzyme using biotechnology, developed at the Gatersleben Central Institute for Genetics and Cultivated Plant Research, in cooperation with a combine partner. This enzyme converts barley starch directly into sugar, and is one of the most heavily-produced technological enzymes. By isolating and transferring a highly active gene for this enzyme into a selected host strain of bacteria, the performance of the latter in forming enzymes increased two to three times over. A striking example of the role of biotechnology as a key technology.

The pharmaceuticals industry is paying a great deal of attention to the cloning successfully carried out at the Jena Central Institute for Microbiology and Experimental Therapy, as well as the successful sequence analysis (determination of the sequence of the building blocks) of the gene for the protein streptokinase--a type of medicine used clinically to dissolve thromboembolisms.

Work in genetic engineering at the Berlin-Buch Central Institute for Molecular Biology has resulted in valuable progress in the area of prenatal diagnosis, as well as in the prevention of hereditary diseases, including Duchenne's muscular dystrophy (DMD), which strikes one in 2,500 newborns and results in death at a young age. In addition, there are several projects for cloning viral genes that cause economically significant animal diseases, the goal being to develop cheaper, better and more effective diagnostics.

It is clear that access to genes will also have a decisive effect on animal breeding in the near future. Attempts at genetic transfers among animals are already underway, in part aiming to transfer genes that will improve the immune systems of animals for breeding and production so that they will become more resistant to certain diseases.

In plant cultivation, there are similar projects, such as the one involved with improving the quality of seed proteins, since these proteins have only one-half to two-thirds of the nutritional value of animal protein and an improvement in this holds out the promise of enormous effects on the national economy.

Although our knowledge of the structure and function of plant genes is still relatively scant, there are already today signs of a wide range of possibilities in the desirable manipulation of plants through genetic engineering, such as in the area of resistance to fungal and other plant diseases, as well as resistance to stress factors (heat and cold). Transferring to non-leguminous plants the ability to use atmospheric nitrogen--as papilionaceae do, thanks to their coexistence with rhizobia--is one of the most difficult projects in terms of yielding results, but one for which breeders apparently have solid plans in the distant future.

On the whole, genetic engineering is making rapid progress, and it is capable of making valuable contributions to improving human life.

12271
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HUNGARIAN CC POSITION ON ACCELERATION OF S&T DEVELOPMENT

AU260751 Budapest TARSADALMI SZEMLE in Hungarian No 2/87 pp 15-21

["MSZMP CC Position of 28 December 1986 on the Acceleration of Technological Development and the Increase in the Efficiency of Scientific Research"]

[Text] I.

The level of technological and scientific development has become a determining factor in the competition between the socialist and capitalist world orders, and is exercising a considerable influence on power relations.

Improving the efficiency and success of technological development is a primary political task in every socialist country. On the initiative of the communist and workers parties of the socialist countries, the CEMA member-countries adopted a 15- to 20-year complex program aimed at promoting technological and scientific development, a program whose main guidelines are in harmony with world trends in technological development and also help the implementation of national programs.

The 13th MSZMP Congress decision stated that the acceleration of technological development and of the efficiency of scientific research, as well as improving the system of political, social, and economic conditions for technological development are important prerequisites for social and economic development.

Ever since the liberation, the technological level in Hungary has increased considerably. We have essentially followed the main international trends in technological development. In certain areas we introduced technologies that contributed to the development of a modern technological standard. Although not to the extent desired, we nevertheless succeeded in developing new products and production structures that laid the foundations for profitable and dynamically increasing exports. The effect of technological development was particularly strong in agricultural production.

Lately, as a result of the worldwide acceleration of scientific and technological development and of the inadequate work carried out domestically, our technological lag behind the economically developed countries has increased. Technological renewal was hindered by a social and economic environment that did not adequately encourage performance and by a decrease in

available resources. The main efforts of economic management were aimed at achieving short-term stability in the foreign economic balance and less attention was directed toward improving the production structure and modernizing technologies.

The level of technological and economic organization of the production process has been lagging behind the average technological standard of products and technologies; modern internal organization of enterprises has not emerged in many places. Production technologies are not adequately in line with the extent of mass production; technological discipline and work standards are not adequate. The level of exploitation of industrial production installations is low compared to the international standard. The proportion of outdated products is large and is decreasing slowly, and the proportion of newly introduced products is also low. Adjustment to market requirements is slow.

The institutional and financial system of research and development has changed. There has been an increase in the role played by the enterprise's technological development activity. The new organizations aimed at introducing research results have begun their activity. Contacts between research institutes, universities, enterprises, and cooperatives have become closer. There has been an increase in the enterprises' freedom of decision in financing technological development. There has been progress in the support provided by the banks for technological development and in the coordination of research and development, and economic programs.

However, scientific and technological progress has been slower than was necessary and possible in the past 1 and 1/2 decades. The lagging behind in technological development has increased in several important areas; we have been in danger of getting into a disadvantageous position compared to countries that were previously on the same level with us or less developed.

The implementation of the decision of the 13th Congress, solving the tasks set out by the 7th 5-Year plan, and the implementation of the Central Committee decisions of November 1986 makes it imperative to increase the efficiency of technological development and scientific research. In order to achieve this, we should determine the fundamental directions and strategic tasks of the technological development policy, and the concrete tasks in implementing this policy.

II.

1. Scientific and technological progress is an objective process that is manifested in social production and which transforms the structure of the economy, production, and consumption and, as a global effect, contributes to the acceleration of social development. Scientific and technological progress is a fundamental social process, both from the viewpoint of its conditions and its consequences. Its driving force is the need to fulfill society's needs at a higher level.

The efficiency of technological development depends on the society's readiness for innovations, the interest of economic organizations and individuals, and the quality of the human factor. In order to work out a correct strategy for technological development, there is a need for joint consideration of all social, economic, and technological factors, and for their coordinated development.

2. Technological development is an activity that takes place decisively at enterprises and cooperatives, and is aimed at increasing competitiveness and profitability, an activity mainly directed by demand and in which competition is one of the main incentives. The real stage for technological development is the enterprise or the cooperative.

3. Central guidance, the task of which is to determine priorities, work out the strategic goals of technological development, and form the social and economic conditions for this technological development, is playing an increasing role in technological development. There is a need to strengthen the application of economic means and indirect methods in management.

We should increase the role played by central planning in introducing new production standards that determine the international competitiveness of the entire economy, in accelerating technological modernization, and in developing the infrastructure. People's economic planning should be made suitable for setting out the long-term direction of scientific and technological progress, determining the medium-term technological development goals, and ensuring the necessary conditions to achieve these goals. The harmony between the social, economic, and technological development goals should be strengthened.

4. A fundamental condition for technological development is the need to improve society's and the economy's readiness and capacity to absorb new technological results, and to increase their interest in ventures. It is possible to achieve this in an economic environment in which, in addition to other factors, continuous technological development enables the profitable operation of economic organizations. The economic management system plays a determining role in developing such an environment. In the course of further developing this system, we should deal with the social economic, and technological factors in accordance with their real weight and taking into consideration their interaction.

5. The new technological solutions are the results of considerable research and development activity. It follows from our country's objective endowments that the economy can follow the trends of technological development only on the basis of international cooperation. The need to adopt from abroad everything that is necessary and that can be purchased under rational conditions is a fundamental principle. We should, however, contribute to the quick and efficient application and further development of the procedures adopted from abroad by means of our own scientific and technological development activity. The development of the socialist countries' scientific, technological, and production cooperation is particularly important.

Domestic instruction and research should contribute to mastering the necessary technological knowledge and standards for the application and further development of both domestic and foreign results.

A better utilization of the scientific basis should be attained by means of organized cooperation between research institutes and institutes of higher education, and by means of joint associations to be established with the enterprises.

6. The human factor plays a determining role in the acceleration of technological development. There has been an increase in the importance of general education, working standards, the organizational level, readiness for cooperation, and encouragement for creative work in the course of efficiently applying modern technology.

The leaders' activity has a fundamental influence on technological development. Working out a thoroughly considered and long-term strategy, flexible adjustment to changing conditions, and optimal management of power resources all depend primarily on the leadership's qualifications.

On the basis of the party and state decisions concerning cadre work, the guiding organs and the organs that exercise proprietary functions should see to it that people with thorough knowledge who strive for results, who are ready for ventures, possess adequate foresight, judgment and ability to organize, and who take a stand for the implementation of the party's policy head the enterprises and the institutions.

III.

The main directions and tasks of the technological development activity going on in the country are included in the 7th 5-Year Plan for the people's economy, the central economic development programs, and in the medium-term research and development plan programs that are coordinated with the above.

1. International experience shows that modernization of technologies is one of the fundamental conditions for accelerating economic growth and improving efficiency. Technological modernization that increases profitability should also be regarded as a main task in the domestic technological development. This includes, among other things, efficient material and energy consumption, the development, application, and introduction of material-saving procedures, machine-production technologies, introduction of electronics, of computer technology, and of biotechnology, as well as the development of production infrastructure areas that are important from the viewpoint of technological progress. In connection with development, increased environmental protection is an important requirement.

2. The implementation of the technological development goals set out in the 7th 5-Year Plan is of decisive importance from the viewpoint of the entire economy. Therefore, assuring the financial conditions for the stipulated technological development activity should be regarded as a fundamental

economic requirement. At the same time, a concentrated, adequately differentiated, and economical utilization of financial means should be attained on all levels. The technological development of important areas that contribute primarily to the improvement of the long-lastingly efficient and competitive economic organizations and of the production structure should be accelerated by means of coordinated measures. This should also be attained by means of technological imports that take export requirements into consideration.

3. The resources necessary for technological development can be created partly by regrouping the social capital among the enterprises and partly by increasing investments to a permissible extent. An increase in the proportion of investments aimed at modernizing production technologies within the investments stipulated in the 7th 5-Year Plan is justified. This should be connected with the implementation of reorganization and curbing programs necessary from a political, economic, and technological point of view.

4. In accordance with the decisions of the 13th MSZMP Congress, the financial means allocated for research and technological development should increase faster than the national income. A central technological development fund aimed at solving tasks within the authority of the government and sector management will continue to be needed in the future too. The central technological development fund can be increased in accordance with the tasks. It is practical to use a part of the central fund to increase the basic capital of financial institutions that finance innovations.

It is practical to completely eliminate the obligatory formation of the enterprise technological development fund. The enterprises should decide independently on how they use their financial assets in the innovation process.

The enterprise technological development activity should also be promoted by creating a long-term proprietary interest, strengthening competition, implementing efficiency requirements, and by increasing cooperation readiness and discipline. The flow of social capital among enterprises should be accelerated in order to modernize the production structure.

5. Basic research and development should be promoted by increasing financial resources, by making a differentiated use of these resources, as well as by taking previous efficiency into consideration, and by improving the competition system and the assignment system.

The number of research subjects should be reduced and the intellectual and financial resources should be concentrated on the most important tasks. The financial conditions for basic research should be assured primarily in the state budget. It is justified to develop favorable conditions for the support of basic research carried out for enterprises that are interested in applying the results, and to develop tax-exempt conditions for these enterprises.

6. Production and trade enterprises should play a decisive role in setting out the tasks of applied research projects and in evaluating, making use, and financing the results. The proportion of long-term cooperation projects should be increased in this area too. This should be facilitated also by the government and sector programs.

Economic organizations should pay great attention to ensuring the supply of experts for their technological development bases and to improving the material conditions of work; they should expand the circle of computer-assisted activities and increase the stock of instruments used in quality control.

7. A lasting division of labor based on mutual interest should be worked out between research institutes and institutes of higher education and the enterprises in order to attain a practical utilization of scientific research. The technological development goals of the production, education, and research organs should be coordinated. The establishment of new cooperating organizations should also contribute to shortening the time needed to apply the results of technological and scientific research in practice, to an economical and efficient use of material assets that serve common goals, and a better utilization of research installations.

8. Improving the enterprises' internal organization is an important condition for the acceleration of technological development. The enterprises and cooperatives should develop an internal organization system that flexibly adjusts to the technological and market requirements and which is operated by a small staff of cooperative management experts capable of making decisions. The modernization of the internal organization should promote innovation activity aimed at fulfilling consumer demands and a production organization adjusting to these demands.

In the process of enterprise innovation it must be ensured that production and technological development are decisively guided by the quantitative and qualitative requirements of the demand. The establishment of associations between research, production, and marketing organizations--associations based on mutual interest and risk-taking--should be encouraged. These associations contribute to the fast purchase, application, and marketing of new technological results. Research, development, production, and marketing cooperation that is indispensable for technological development should be promoted by improving the cooperation among domestic economic organizations and by promptly fulfilling the obligations stipulated in the contracts.

9. Enterprises should considerably improve their knowledge of the technological, economic, and business developments that determine international market potentials. In order to increase their level of information, enterprises should make better use of international organizations and meetings, study tours, and the forms of direct cooperation between enterprises and institutions. The enterprises should improve the technological, economic, and personal conditions of joining the international information network.

10. The development of international cooperation and the widening of technology-trade possibilities are of determining importance for the country's technological development.

Our cooperation with the socialist countries, primarily with the Soviet Union, plays a determining role in our international scientific and technological relations. The main trends and tasks of this cooperation are included in the comprehensive program of scientific and technological progress through the year 2,000. It is a government and enterprise task to continuously develop the content and quality of our participation in this program.

Our participation in the comprehensive program should contribute to achieving our technological development goals and to the fast and efficient application of scientific and technological results, and it should concentrate on the main tasks aimed at promoting the country's economic development. We should also contribute to the implementation of our scientific-technological and economic goals by establishing joint research-development and production-marketing organizations.

We consider it important to maintain and expand the technology trade that promotes technological progress, and other forms of cooperation and contacts with the capitalist countries. In addition to technological knowledge, we should also pay great attention to acquiring knowledge concerning production organization and management.

The various types of cooperation and joint ventures, development and production cooperation projects, and license purchases should be directed toward procedures that enable lasting, efficient marketing, procedures whose further development can create conditions for continuing competitiveness and a reduction of capitalist imports. The establishment of efficiently functioning foreign and domestic joint and mixed enterprises that facilitate the technology trade should be encouraged and the conditions for involving active capital should be improved.

11. The system of economic regulations should contribute to technological development primarily by steadily asserting the efficiency requirements, strengthening competition, and by increasing the economic organizations' readiness for cooperation. Modernization of the pricing, wages, and tax systems, which influences technological development and which is currently in progress, should contribute to the implementation of the tasks. Along with determining the normative benefits aimed at facilitating technological development, the enterprises should be made interested in reducing expenditures and increasing performance. The scope for maneuver of the enterprises that operate efficiently should be expanded by gradually reducing income centralization in harmony with balance requirements. This should help the enterprises to secure the necessary resources for their technological renewal.

Economic regulators should be predictable and should enable a safer evaluation of the consequences of both short-term and long-term economic and technological development decisions.

IV.

1. The system of interests and of material and moral rewards for professionals that contributes to the mobilization of intellectual and material reserves is of fundamental importance in technological development. Enterprises and cooperatives can do a lot with regard to material and moral rewards for the economic organizations' technical intelligentsia. Central management should promote this by providing an adequate income and wage regulation system. The wages of technological personnel at the beginning of their career should be established in a way that would increase the appeal of the engineering profession in accordance with its importance.

The state, public, and interest-representing organizations should see to it that an enterprise's professionals receive the wages and rewards appreciation that are commensurate with their considerable technological performance.

The mass media should contribute to increasing the prestige and appeal of technical, agricultural, and economic careers. The media should strengthen the prestige of productive activity by presenting people who have achieved outstanding results in creative work and their successful careers.

2. Technological development is inconceivable without skilled workers. Therefore, the personal and material conditions of training skilled-workers should be improved. The enterprises' direct participation in vocational training should be increased. Supplementary training programs should be coordinated with the requirements deriving from technological modernization of the enterprises and of the people's economy. If the change in product structure requires manpower regrouping, enterprises should ensure the necessary retraining activity.

By improving the organizational and financial conditions, the level of instruction at the technological and agricultural institutes of higher education should increase. We need professionals who are ready to continuously renew their knowledge, who are trained for cultured, disciplined, and precise work, and who accept our socialist goals. It is justified to modernize the technical equipment of these institutions, with particular stress on developing a computer-science background. In training technological professionals there should be increased instruction in economic subjects and leadership. There is a need to create a situation in which the contents of the training of skilled workers, technicians, plant engineers, and certified engineers are interdependent. Accelerated technical development requires that the possibilities of supplementary training for engineers be broadened. The economic organizations should increase their contribution to the activity carried out by the institutes of technological and agricultural higher education. A larger number of enterprise professionals who are rich in experience and possess outstanding knowledge should be involved in higher education. The role played by the branch ministries and the National Technological Development Committee in modernizing technological higher education should increase.

V.

The party organs and organizations should assist in creating the political conditions for technological development and creating a social environment that supports the creative activity of collectives and individuals.

In order to mobilize human resources and activate personal capacities and willingness, the enterprise and institution party organizations should increase their activity primarily in the struggle against mediocrity, in having the differentiated financial rewards accepted, in supporting initiatives for new solutions, and in dealing with the conflicts inherent in the process of renewal.

The district party organs, organization, and communists should acquaint people with, represent, and support the Central Committee position, and should participate in implementing the tasks. They should contribute to improving the local social conditions for technological development activity. They should consistently assert the principles of cadre policy and support efficient leaders who demand discipline and encourage new initiatives.

The Central Committee calls upon the Council of Ministers to work out, by the end of the first quarter of 1987, a work program for the implementation of the tasks included in the position, and to determine the tasks of the competent state organs.

The Central Committee obligates the party organs and organizations and calls upon the public and mass organizations to work out and determine, by the end of the first half of 1987, their political tasks in facilitating the acceleration of technological development.

Propaganda, the mass media, and the professional press should constantly deal with issues of technological development and present the results of the efforts made for the benefit of technological development.

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CSO: 2502/51

BRAZILIAN FIRMS TO EXHIBIT S&T, OTHER PRODUCTS, IN HAVANA

Rio de Janeiro O GLOBO in Portuguese 10 Oct 86 p 16

[Text] More than 120 Brazilian companies are getting ready to participate in the first exposition of Brazilian products and services in Cuba, planned for 18 to 22 May. The event will be officially opened by Cuban President Fidel Castro. A 163-seat charter flight has been made available to the Brazilian businessmen by Cubana airlines, and there are high hopes that the agreements signed by Minister of Communications Antonio Carlos Magalhaes will begin to bear fruit in the form of signed business deals.

In addition to the telecommunications area, the Cubans are interested, in principle, in all the products and services Brazil has to offer, said Mario Sosi, director of the Convention Palace in Cuba, who is in Rio taking personal care of the preparations for the exhibit and the three other congresses that the country is organizing for this year.

According to Agnaldo Acioli, the Director of Fairs, Expositions, and Congresses Ltda. (Foco, the company that is organizing the event from the Brazilian side), there are plenty of possibilities for business. "By itself, Cubalse (equivalent to a trading company) has already said it may buy more than $20 million worth. And this is just one of the 60 Cuban corporations," Acioli said.

The Foco director has already been contacted by the Cubans, who are asking him to consider holding an event to pormote Cuban products in Brazil. According to Acioli, it won't be long before such an exhibit is arranged, and it will be held in Rio de Janeiro.

Steel, alcohol production, hospital and medical equipment, trucks axles, construction and foods are also areas that interest the Cubans. Agnaldo Acioli cited some of the companies that have already confirmed their participation in the exhibit, such as Fundicoes Tupy, White Martins, Volkswagen, Telebras, and Modata and the trading companies Costa Pinto, Spasa (affiliated with Alpargatas) and Disco Trading. Small and medium-size companies will also take part, represented by Flupeme (Fluminense Federation of Small and Medium-Sized Companies) and Cebrae (Brazilian Center for Support to the Small and Medium-Sized Companies.)

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CSO: 3699/59

BRAZIL'S SEI TO BE DECENTRALIZED

Rio de Janeiro DATA NEWS in Portuguese 23 Dec 86 p 5

[Article by Mari-Angela Heredia]

[Text] Last Wednesday, the Special Secretariat of Informatics gave the press something very unusual: an official communique on informatics. An agreement between the Ministry of Science and Technology and the Ministry of Foreign Relations resulted in the release of the document, intended to show that the secretariat really is "changing."

"Important decisions were made at the end of 1986 that laid the basis for modernized administrative methods at SEI with a view to simplifying and systematizing the decision-making process in the areas of imports, investment project review, regulation and protection of the intellectual property represented by software, and the decentralization of responsibilities," the communique reads. In this context, it makes special mention of the reorganization of SEI which, authorized by President Sarney to expand its technical staff by about 30 percent, will be substantially stronger in terms of technical and administrative capacity.

Another change is the setting of approximate deadlines for decisions on import and manufacturing applications. In principle, decisions will be made within 60 days; however, this may be extended by 30 days by notifying the applicant company.

Appeals

Where a case requires more complex analysis, the deadlines may be changed after consultation with the applicants. "But SEI will not permit indefinite deadlines."

The communique notes that all SEI decisions may still be appealed to the National Council on Informatics and Automation (CONIN). The paper drafted by SEI also emphasizes the reformulation of Cacex Communique 41 (which cut the list of products by 40 percent and reduced the system of advance and automatic consent, as a block, for an indefinite period of time (sic)).

The annual import plans are also new. After obtaining approval of their "Brazilianization" plans, companies may get a decision from SEI on their annual import programs, with advance approval of their license applications for a certain period (usually 3 months) for each year.

U.S., JAPANESE DISPUTE BRAZILIAN MARKET FOR DISK DRIVES

Rio de Janeiro DATA NEWS in Portuguese 12 Jan 87 p 12, 13

[Article by Wanise Ferreira]

[Text] The race to conquer the large-capacity disk drive market is about to begin. IBM, in a comfortable position, will be selling products this year that are assembled in its factory in Sumare, a city in the interior of Sao Paulo State. Sid and Elebra, its competitors, signed contracts in that area at the end of last year and want to continue a policy of distributing and supporting Fujitsu and Hitachi large-capacity disk drives which will enable them to charge competitive prices. Meanwhile, Microlab prefers not to take risks in the peripherals market for mainframes with a single disk project and is asking the Special Secretariat for Informatics to let it add high-performance tapes.

At any rate, all these companies will be involved in serving a market calculated at 300 to 500 units per year. The competition among them promises to result in some clever moves for 1987, especially since IBM obtained authorization to manufacture the very large 3380 subsystems (2.5 and 5 Gbytes.) The company spent approximately $70 million dollars on its disk drive factory, more than half of which went to build a "clean room."

That authorization took the market by surprise just at the moment when two Brazilian companies, Sid and Elebra, were getting ready to fight for a share by competing with imported large-capacity disk drives. Sid allied itself with Fujitsu, and Elebra reached an agreement with National Advanced Systems, which is responsible for Hitachi's OEM operations in the U.S. market. Microlab, also in the race, has technology from the American company Storage Technology (STI).

The first two companies, having already recovered from their shock, went ahead with their plans and agreed on one point: the prices must be kept at a level that makes it possible to compete with IBM disk drives made in Brazil. Therefore, the idea of achieving high percentages of domestic content in the products is likely to be abandoned gradually. "The price is the factor that can make or break a sale, since the machines are about equal in terms of quality. Therefore, the indices of nationalization

must be consistent with the dictates of competitiveness on this item," observes Manoel Paes, director of the PC/M division of Elebra Informatica.

Nationalization?

The plans to nationalize the Fujitsu disk drives will be initiated by Sid beginning in June, but will also obey the dictates of competitiveness. "We want to import the machines unassembled and nationalize what can really be made here. We must remember that there has been no industrial experience with disk drives at Sid," emphasizes Nelson Wortsman, managing director of the company.

The investments made at both Sid and Elebra were aimed at developing a distribution, support, maintenance and marketing structure. "It is unlikely that the Hda of the Fujitsu products will be opened in Brazil, because the market numbers don't justify the level of investments that would have to be made," says Wortsman. Paes agrees with this, arguing that heayy investments in technology would keep the Brazilian companies out of the race.

The route they have chosen may be the right one, and the two companies are confident of this. At the end of last year, Sid signed contracts with Petrobras, Furnas, Esso, Atlantis, Dataserv, and Banco do Progresso which took care of its quota of 60 Gbytes. In 1987, it wants to sell 400 Gbytes, which could earn it $15 million. Sid has usually leased its disk drives.

Elebra sold three 5-Gbyte drives and a controller to Souza Cruz in a transaction that was worth about $600,000. In 1987, using both direct sales and leasing, it expects billings of 70 billion cruzados.

Imports

However, in Paes' opinion there is a problem that could affect all the company's plans. He is worried about the government's actions in the exchange area, which could cause difficulties with imports. He stresses that "If there is centralization of exchange and difficulties in importing, this could be crucial for the companies in this industry segment." It is for exactly this reason, he says, that the companies are gathering data in order to be able to approach the government agencies involved and demand the ability to operate in that area.

"If the government attaches priority to equipping the domestic industry to enter the market for mainframes, then the industry must be given this ability to operate freely," he emphasizes. That concern is also justified, according to Paes, because when there are problems with importing, the multinational companies have some resources that do not directly involve the balance of payments. For example, they have the drawback, with which they can bring in parts and pieces to be assembled here for export. Under that procedure, 5 percent of the production is authorized to be marketed in Brazil. "The domestic companies cannot take advantage of this, because they would have to send dollars to the foreign supplier," he noted.

Another problem he foresees this year concerns the re-leasing of the IBM 3375 disk drives, which have a capacity of 800 Mbytes. "Those drives will be re-leased, with the initial import duties already amortized and, consequently, at a much lower cost."

But at any rate, the experience with the disk drives has served to prepare Elebra and Sid to distribute other products in that industry segment. "The disk drives are part of Sid's strategic plan to expand its product line outside the market reserve," Wortsman commented. Elebra, too, is already investigating the possibility of supplementing its line with products from other suppliers.

Tapes

Microlab does not want to wait to expand its product line and is already trying to market high-performance tapes in Brazil, using technology from STI. The company was one of the most affected by the decision to authorize IBM to make disk drives in Brazil, because it had planned to achieve a high domestic content in its product, including a proposal for a sealed unit, the Hda.

Those plans were redrawn, but Microlab prefers to add production of high-performance tapes, competing in Brazil with tapes imported by IBM, BASF, and Memorex. "With the entry of IBM into the disk market, the shares of the three Brazilian companies have fallen sharply. Tapes will give us a chance to use the same structure for the two products and reach a sales volume of $8 million in that area by the end of the year," said Sergio Henrique, the company's marketing director.

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JAPANESE ACTIVE IN BRAZILIAN ELECTRONICS MARKET

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[Article by Rosane Serro]

[Text] Rio de Janeiro--Riotec S.A. and NTT International, a Japanese telecommunications consulting and services firm, held discussions last December regarding a future program of technical cooperation between Rio's informatics companies, NTT, and Japanese components manufacturers.

According to Riotec's president, Flavio Grynzpan, the meeting with Toru Uehara, vice president of NTT International, did not result in any concrete commitment but it was decided that experts from Riotec and NTT would meet to determine the priorities of the cooperation agreement and its technical feasibility. Nor was the form of the proposed agreement decided--whether a transfer of technology or a joint venture.

Reaching an Understanding

Since NTT is not a manufacturer, its contract with Riotec would be for a technology pass-through. Grynzpan said that the cooperation between Rio's companies and the Japanese firm could take place on three levels: setting up the transfer of technology and the knowledge acquired by NTT through its research in fields ranging from components to integrated systems; participating in cooperation programs with NTT's own suppliers; and contacting Japanese manufacturers such as NEC, Toshiba, and Hitachi to see whether they might give access to the Brazilian companies.

Although the initial contact was only informal, the Riotec associates already have a list of priorities, which include the transfer of industrial process technology, fifth-generation computers, automation of logic circuit projects, and artificial intelligence.

NTT can offer experience in the areas of chip manufacture (LSI), fiber optic communications, and integrated services digital networks. The latter information is already available to Telebras, for which NTT has done consulting work. What most fascinates the officers of Riotec, however, is the opportunity to use the research laboratory maintained by the Japanese company.

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